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LECTURES

ON

MATERIA MEDICA AND THERAPEUTICS

Compiled by

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I N T R O D U C T I O N .

In the following lectures we have to deal with Materia Medica, Pharmacology and Therapeutics, three names which have found quite different definitions but which we must consider as one.

It is worth while to give a short history of our science, at the same time pointing out the manner in which the matter will be dealt with. No matter what the title the main object must be to get a full knowledge of the way in which we treat diseases.

What constitutes disease? The main difference between an organized and inorganized substance lies in the fact, that the form of the organized substance undergoes constant metabolic changes, new material is constantly taken up and changed on its way through the organism. These changes are maintained mainly by our food stuffs, and agents acting from within and without. A certain change in the modifying factors is necessary for the continuation of the living organism, but the organism is capable of compensating for these changes to a certain degree, so that the individual organism remains more or less constant in its form and composition. This power of compensation has certain limits which depend upon the condition and individual circumstances. If the modifying influence of our metabolism remains within lawful limits, the conditions for the continuation of life remain the same. If the power of compensation fails then new conditions will be formed, the effect of the change will not be overcome, and the organism may partly or wholly suspend its function. This condition is called Disease.

The changes from normal which constitute disease may cause such modifications that normal metabolism and life may be impossible and death result; or be less evident and only change the metabolism to a certain and fixed degree, constituting chronic disease where life is prolonged. The changes may not be fixed and may be removed and normal conditions restored; then we say that the disease is cured.

Internal and external agents may be the cause of the changes in the metabolism and bring about disease. Agents exist which bring about changes in the diseased organs and restore normal metabolism, that is, cure the disease. These agents are our therapeutic factors.

The first duty of the physician is to try and remove the cause.

This removal of the cause is called causa causaris. By removing the cause of disease or trouble the organism may through its own effort be restored to its normal condition. For example in worms, by removing the intestinal parasites the organism will through its own effort restore itself and the anaemia, loss of flesh and gastric disturbances will disappear by the compensatory power of the organism. Very often the organism cannot bring about these changes so that it is impossible for it to restore itself by its own effort.

The physician must remove all the pathological conditions, or the most of them, so that the organism may overcome the rest and the normal metabolism take place. If really such a result is accomplished the medical cure is complete. Such cases are however rare because the pathological changes due to the disease are usually beyond repair when we see or recognize the disease.

In such cases where a cure is impossible, he must try to form new and artificial conditions for the organism so that the necessary metabolic changes may take place with the least possible discomfort to the patient, that is to bring about the best possible conditions to prolong the patient's life.

By what means do we try to restore normal metabolism and treat disease? There are many methods but all can be classified more or less correctly under four different headings.

I. DIETETIC.

II. SUGGESTIVE.

III. PHYSICO-MECHANICAL or SURGICAL.

IV. MEDICAL, or the treatment by drugs.

A few short remarks of at least a few methods belonging to the many classes will illustrate the evolution the science has undergone. The most absurd treatment will find credulous people, all of whom do not belong to the uneducated classes, as the strongest adherent of many absurd theories often belong to the higher classes of society.

DIETETIC TREATMENT. To this belongs the influence quantitatively and qualitatively of food stuffs. Our food stuffs consist of proteids, carbohydrates and fats. Carbohydrates and fats exclusively can be borne for a longer or a shorter period but beyond this a certain amount of proteid material must be taken to maintain the metabolism. Regularity of diet is the main factor of the cure under this method. The so-called PHISIATRY or Natural Healing Method of old Greeks according to Herodotus was nothing but a methodical lecture to live naturally, but modern teachers go much

farther. Some of them live in caves, reject a good deal of our clothing and teach that only uncooked foods should be used. The more sensible adherents do not go to such extremes but they reject all drugs and believe only in exercise, water internally and externally, and fresh air. A special offshoot of this is the so-called

HELIO THERAPY. This method consists simply of exposure to the sun's rays, the patient of course being undressed.

AEROTHERAPY, The main point in this method consists in the regulation of respiration, and by the use of apparatus by means of which the patients are enabled to breathe more condensed or diluted air. Medicated substances in the form of vapors may also be used.

JOHANNAS SCHROTH'S METHOD belongs under the dietetic. He omitted the fats from the food and also reduced the quantity of water. The diet list consists mainly of stale bread. This method was employed principally in circulatory failure and the subsequent accumulation of water in the system, and localized in the pleura and peritoneum. There is more water given out than taken in and patient is dried out of the accumulated liquids in the system. This Schroth method is generally known as the Banting cure. Banting was treated and cured by it and made Schroth's secret public. A modification of this treatment was published by Professor Oertel in Munich. He uses exercise and a very limited quantity of water and under this modification was completely cured of his circulatory trouble.

DR. SCHWENINER, body physician to Bismarck, used the modified Banting cure on him and reduced his weight thirty pounds, and so it is now generally known as Schweniniger's cure. The restriction of liquids is so that more water is given off than is ingested. Under restricted liquid diet the proteids of the system are more easily oxydized and the body weight diminished.

Treatment through special form of clothing. The most widely advertised is Jaeger's Normal Wool Treatment. Jaeger as a result of his wool treatment or trade readily found others to imitate his treatment. Not quite a dietetic treatment, but better spoken of here is the Balmio or Hydro-Therapy. This consists of the external application of water only, the internal use of it belongs to the medical treatment. Warm baths may stop pains, hot baths act as stimulants to the circulation, increase appetite and facilitate the general metabolism. In olden times the different baths played a

great role in medical and preventive treatment. The ancient Romans used them quite extensively. The Teutons or old Germans abandoned their use and until the present century but little use was made of bathing. In the beginning of this century a catholic priest Sebastian Kneipe preached the external use of water. This treatment had many adherents. He recommended not only the external use of water but also walking with bare feet in the meadows. This latter has cost many their lives.

Schooner in his shameful treatment found many adherents. He gave a sitzbath and massaged the hips and prepuce in the male and the great labia in the female.

SECOND MAIN CLASS OF TREATMENT. Physico-Mechanical, Masso-Therapy or Massage. This treatment was in common use thousands of years ago, especially in the far East. The Chinese and Japanese were most advanced in this art. The old Greeks and Romans used it for the sick and healthy. Later massage was entirely forgotten and only came into use in the latter part of the last century. Internally massage of mucous membranes is not used so much here as abroad. In massage where the patient is forced to do active movements the treatment is known as the Swedish Gymnastic Treatment.

ORTHOPEDIC TREATMENT, which may do so much good in many cases of deformity, will be taught later by a competent authority in this school.

VIBRATORY TREATMENT, by ^{Charet}~~Schärge~~ and pupils, is one in which either the whole body or one or the other of the extremities are made to vibrate by the aid of mechanical apparatus. It is claimed to cure nervous diseases. It has but few adherents outside of Paris.

Lastly the FRIGOTHERPY, invented by the celebrated physicist Pictet. The patient is exposed to minus 100°C. The difficulty in making this process has made it impossible to say what benefit results from it. In spite of the name connected with it, it has not found many adherents.

ELECTRO-THERAPY. The different forms are Galvanization where a constant current, Faradization where induced current is used, and Franklinization.

^{Mittell}~~METAL~~ THERAPY and MAGNO-THERAPY. In the first heavy plates are used and in the second magnets. These are only used in nervous patients.

SUGGESTIVE METHOD is the next main class, By this method the

patient is made to positively believe that all that is said is really so, quite independent of the truth. In this kind of treatment the first thing to do is to influence the patient so that he will believe that he will positively and absolutely be cured. A complete suggestion will be more easily accomplished by a man whose fame is well established.

A manifold apparatus which will impress the patient may assist greatly in this. Under such conditions it does not matter whether he has studied medicine or not. A patient believing in such a treatment may be cured by using the treatment himself. This is called Auto-Suggestive.

One of the latest methods of suggestive treatment is the so-called SYMPATHETIC METHOD. Here cures are believed to occur through the secret healing power of a substance or body which has no remedial value in itself, but stands in some connection with the disease. Warts and epilepsy are the main troubles treated in this way. In certain parts of Europe small pieces of warts are buried in a certain manner, it being thought that by so doing the whole warts will disappear. Another method of suggestive treatment is the SPIRITUALISTIC. Here in Boston is a good opportunity to see this method in operation.

CELESTIAL METHOD is another suggestive method. In it pictures of saints and other religious objects are supposed to have healing powers.

The most important of all is the HYPNOTIC METHOD. Forrell explains it as a modification of the ordinary function of the brain, according to him, not only by the will of the second person but also by the will of himself. In the hypnotic state many objective functions of the nervous system may be influenced, such as the will. According to Forrell this hypnotic state may influence all sensitive and sensory phenomena, such as pain, anesthesia, blindness; the different motor phenomena as paralysis, stiffness, motion and action, and further physical effects as sneezing, vomiting, yawning and lastly the different vaso-motor and constrictor phenomena as sweating, defecation, menstruation, etc. Influence upon all these phenomena may last according to him after the hypnotic effects. There are different explanations of this but they are beyond the scope of these lectures.

Of the different medical treatments some of them are similar to the symphathetic treatment and will be considered first. Professor Jaeger's (of the wool fame) is called Anthropin Therapy. In severe external trouble he gave pills containing the skin of other robust

phenomena may last according to him after the hypnotic effort.
There are different explanations of this but they are beyond the
scope of these lectures.
Of the different medical treatments some of them are similar to
the hypnotic treatment and will be considered later. Professor
Jaberg's (of the wolf den) is worth a mention. In severe
external trouble he gave pills containing the bark of a horsetail

neighbors. If trouble was with the hair they were given the hair of some other patient, etc. This therapy was a swindle. The same is true of ELECTRO-THERAPY. This consists of pills which pretended to be loaded with blue, green and red electricity and were capable of curing all disease. It is suprising how many adherents this had one of them being a very well known physician.

HOMEOPATHY. The recognized founder of this was a German physician named Hahnemann. The principal publication was in 1810, entitled *Organum der Rational Heilunden*. To Hahnemann belongs the credit of making it what it was in Europe, but this method is not recognized there in a single medical school now, but only in this country. This method of treatment pretends to cure the different symptoms of a disease with a similar disease, or with such drugs which in larger quantities would produce similar symptoms in a healthy person.

Hahnemann's teachings may be briefly summed up as follows:

I. Every disease is caused through the ill temper of the purely spiritual function of life and is entirely immaterial.

II. As the real cause of the disease is not known or not to be understood the physician therefore must limit his efforts to removing the symptoms of the disease. Homeopathy only tries to remove the symptoms, never the cause.

III. The cure is not made through the vital forces of the organism, but through a new and similar affection, which must be stronger in its effects than the original. This new affection is created either spontaneously or made artificially through the treatment.

IV. This condition is artificially brought about by drugs which in healthy people produce a similar disease to the one desired to be cured.

V. Large doses of medicine make people sick. Drugs do not act curatively through their own substances but act through the immaterial powers which they possess. This immaterial power acts better the more dilute the drug, that is the more the material body is disguised.

VI. Besides the medical treatment, a dietetic treatment must also be used.

VII. Certain diseases like syphilis, etc., are not curable.

Homeopathic medicines are prescribed in three different forms.

1. As mother tinctures and their dilutions with alcohol simply called Dilutions.
2. As powders mixed with sugar, called triturations.
3. In the form of pellets (small pills) moistened with the solution. Dilutions of the mother tinctures or of the powders are al-

11

.

or

be

ways made in the proportions of 1-10, 1-100 or 1-1000, called first second and third potents.

It is not intended to criticise the efforts of Hahnemann. It must be remembered that at the time he published his books Therapeutics was at the lowest ebb, there was absolutely no experimental medicine, physiology was just becoming a science and physics did not enter into the study of medicine. A few years after his publication the medical faculty of the University of Vienna declared that all drugs were worthless in the treatment of disease, and even went farther and said that drugs did harm.

Besides the homeopathic and the so-called allopathic method, must be mentioned the ECLECTIC. This school pretends to select just the right thing from the homeopathic and allopathic remedies. Of course this method has no scientific basis.

This short résumé of the different therapeutical methods will give you an idea of the changes that our science has undergone in the past. As a whole it is not an edifying picture. In the second half of our century a decided improvement has taken place; physics and chemistry have been introduced, and physiology has made great progress. Other scientific branches as pathology and bacteriology have enlightened us on the nature and etiology of the different diseases. The progress in chemical diagnosis has helped us to recognize the disease in the living subject, and wherever it was possible an idea or hypothesis had to be proven before it was acceptable. Of course the change in the whole system of medicine has affected our science. Experimental proofs have been introduced into the treatment of disease. We no longer judge a drug from the supposed action, but study its action by experiments. This had to be done in order to classify ours as a rational science.

The action of drugs will be studied first, later Materia Medica and the prescribing of drugs, and then as far as possible Therapeutics.

C O R R E C T I O N S .

Introduction Page IV Line 25 Schargo should be Charcot.
 " " IV " 39 METARCI should be METALLO.
 Page 7 Line 2 inaccomodation should be incoordination.
 9 19 new halogen should be non halogen.
 17 35 injection should be ingestion.
 20 3 carbonate of chloride should be carbonate or
 chloride.
 21 24 tough should be touch.
 24 17 MEDRIATICS should be MYDRIATICS.
 26 35 DIMETHYLYXANTHIN should be TRIMETHYLYXANTHIN.
 31 12-14 Sentence on Posterior adhesions should be omitted.
 35 13 GELSEMINE should be GELSEMININE.
 35 15 Gelsemine should be Gelseminine.
 45 36 lastly should be easily.
 45 29 Dose 2.000-5.000 should be Dose 0.200-0.500.
 51 9-10 increased should be decreased.
 54 20 Internally should be Externally.
 54 33 zydine should be iodine.
 70 6 COLOCENTHIDIE should be COLOCYNTHIDIS.
 71 32 Pantonin should be Santonin.
 71 29 The sentence should read as follows:
 For round worms, especially ascaris lumbricoides,
 the following are used:
 160 7 SUBSCRIPTION should be SUPRSCRIPTION.

Syphilis
Malaria

M A T E R I A M E D I C A A N D T H E R A P E U T I C S .

DRUGS. A drug is any substance except the ordinary foods which causes a change in the animal organism by means of a chemical reaction. The changes caused may alter the chemical, molecular or morphological construction and cause changes in the metabolism or functions of the tissue. The alterations produced in the normal functions by a drug are called its action. If the action is beneficial the drug is called a medicine, if detrimental it is termed toxic or poisonous. This classification is not perfect and depends upon the condition under which the drug is used. In order to be called a medicine it must produce changes which are beneficial to the organism. The action of a drug is dependent not only on the quality but also on the quantity of the substance used and the special condition of the organ upon which it is to act.

GENERAL RULES OF THE ACTION OF DRUGS.

I Before a drug can act upon the tissues it must be absorbed into the blood. The only exceptions to this rule are drugs used because of their local action. (See page 62.)

II The intensity of the action of a drug depends upon the amount actually circulating in the blood at any one time. The maximum effect is produced at the time when the greatest amount of it is in circulation. A drug which is slowly absorbed from the stomach and rapidly excreted by the kidneys or other organs may not at any time have a sufficient amount in the circulation to produce its effect. For instance, curare may be eaten in large amounts but if injected in small quantities into a vein or subcutaneously will cause paralysis. If, however, when given by the mouth the renal arteries are tied so that no excretion may occur, the same effect is noted as when injected subcutaneously. The reason for this is that normally the kidneys excrete the drug much faster than it is absorbed from the stomach, so that at no time is there a toxic dose in the circulation.

The results of a drug depend upon the amount given, the method of administration and the condition of the body. The absorption is slowest from the mucous membranes, quicker from the subcutaneous tissue and quickest from the serous cavities. For this reason the

All substances used are volatile. Vapors mixed with air produce surgical anaesthesia. It is not known how narcosis is produced. Taken by inhalation only.

largest dose is much smaller in subcutaneous injection than when given by the mouth. The most rapid action is produced by an intravenous injection.

The warmer the tissue, the more rapid the absorption, as was demonstrated by the experiment on three frogs in which the same amount of picrotoxine was injected. Forty minutes elapsed before the frog at 0° C showed any effect of the drug, fifteen minutes for the one at 16° C, and only eight minutes where the temperature was 32° C. Other circumstances which may affect the action are age, sex, weight, condition of pregnancy, menstruation, lactation, etc.

The looser the chemical combinations of a drug and a tissue the quicker it is eliminated, and the normal function restored.

The effects of drugs are not brought about by destructive action, but as a result of a combination with the organism; that is, the cell structure is not destroyed, but its action is modified as a result of the combination.

DRUGS that affect the NERVOUS and MUSCULAR SYSTEMS.

Drugs which act on the nervous system affect only the nerve cells or nerve endings, the nerve trunks remaining unaffected. The changes that they produce in the central nervous system are of a quantitative nature, and increase or decrease only the excitability. If they decrease it, the action is a depressant one, if they increase it, they act as excitants. The action is manifested upon the central nervous system, that is, the brain, medulla, and the spinal cord, and also the nerve endings; the nerve trunks are not affected. Cocaine is the only exception to this rule.

NARCOTICS. Those drugs which depress the nervous system are termed narcotics. They are divided into two classes, the division being based on the quantitative changes produced on the nervous system.

I Hypnotics. Those drugs used to produce sleep.

II Anesthetics. Those used to produce insensibility to pain.

The feature of their action is depressing as a rule first the functions of the cortex cerebri, then the spinal cord and lastly the medulla, but the order may vary somewhat according to the substance used. With anesthetics the insensibility to external stimuli with the exception of pain is lost first, then the control of voluntary movements and lastly the tone of the muscles is diminished, the body becomes limp, sensibility is entirely lost and unconsciousness sets in. It is characteristic of anesthetics that the respiratory centre is affected last.

loss of pain, unconsciousness, muscular relaxation

Morton used it to annul pain. W. C. Long, Athens
Ga. first to use it in 1842 & 3. Not made public. W. T.
Morton in Oct. 17, 1846 used it. Dr. Warren's patient
etherized by Morton.

Temp reduced.

Vomiting.

It was formerly supposed that anaemia of the brain was the cause of narcosis but Claude Bernard proved that the anaemia of the brain in Nitrous Oxide narcosis was not the cause but the result of the narcosis. Later investigators believed narcosis to be more or less related to asphyxia, i. e., a greater or less destruction of the blood corpuscles. It has been however demonstrated beyond doubt that no destruction of the red blood corpuscles takes place. Hertiz, Bernstein and others investigated the subject and proved that narcosis was due to a specific action on the central nervous system, but just how this action is produced is not definitely known.

Anesthetics are not dissolved in the blood according to the ordinary acceptation of the term. Schmiedeberg and Pohl demonstrated a combination with the morphological elements of the blood and found that the red corpuscles contained more chloroform than the serum. The chloroform is held however very loosely combined. *ethyl ether*

ETHER, OR SULPHURIC ETHER, is prepared by distilling ethylic alcohol with sulphuric acid, and contains about 96% ethyl oxide, 4% alcohol, and a little water. It is a very inflammable liquid, about two and a half times heavier than air, and boils at 36° C. It was first discovered in the sixteenth century, later was lost, and rediscovered in the first half of this, but did not come into use as an anesthetic until 1846. Its action is rapid and powerful, but temporary. Its main use is as a general anesthetic. Locally in the form of a spray it is sometimes used to produce anesthesia. Upon evaporating it produces intense cold, the part becoming quite white on account of the contraction of the blood vessels and local anesthesia is produced. If the vapor is confined or the liquid rubbed into the skin, it acts as an irritant. Upon mucous membranes either in liquid or vapor form it acts as an irritant. The increased and troublesome secretions of the mouth and bronchi which occur when ether is used as a general anesthetic are due to this irritating action. Upon inhalation its first action is to slow the respirations for a few moments, after which they gradually return to normal. This slowing may be found after the inhalation of any irritant vapor such as ammonia and is not due to the ether itself but is a result of the spasmodic closure of the glottis due to the irritating effect of the gas.

The action upon the circulation, if in small quantities, is not marked. It increases the pulse rate somewhat, but not its force. If much prolonged, all the blood vessels become dilated; the body temperature falls slightly; the pupils are first contracted, and

Used in gall stones. Morphine no good. Ether relaxes
muscles also. In convulsions & eclampsia. In some
frictional convulsions.

Found by Simpson Esq as anæsthetic.

Most toxic of all narcotics. - 1.6% will stop respiration
but artificial respiration will bring back life.

Chloroform 5.13%

Ethylamide 12

Ether 48

Alcohol 190.

then may dilate. Upon the heart it increases the number of beats, but as a cardiac stimulant its use is not warranted as it increases only the pulse rate, and not the force of the beat. The pulse wave is apparently greater, due to the fact that the tone of the vessel walls is diminished as a result of the paralyzing action of ether upon them. In spite of the increased number of heart beats there is no increase in the blood pressure, so that its stimulating action on the circulation is only seeming and not real.

The pupils are first contracted but later may become dilated. Ether paralyzes the cortex cerebri after a short primary stimulation.

Internally ether is sometimes used in painful affections of the stomach as an anodyne especially in the form of Hoffmann's Anodyne, a mixture of ether, alcohol and ethereal oil, known officially as Spiritus Aetheris Compositus. The official preparations are

AETHER. Dose 0.500-1.000. 5.
 ✓ SPIRITUS AETHERIS. Dose 1.000-4.000. c.c.
SPIRITUS AETHERIS COMPOSITUS. Dose 2.000-4.000. c.c.
 0.1 - 1.0 1 - 5 c.c.

CHLOROFORMUM is a limpid, colorless, heavy liquid of an ethereal odor, and sweet taste, having a specific gravity of about 1.5. Soluble in two hundred parts of water and seven parts of alcohol.

Its external actions are practically identical with ether.

Internal. Salivation and bronchial secretions are increased, but not so marked as with ether. In small doses its action on the stomach is to relieve pain, vomiting and flatulency. In full doses it may cause vomiting, *not so much as in ether*, as is frequently seen in complete anesthesia. A few drops inhaled from a piece of cloth or a sponge rapidly soothe the respiratory nerves, and may be used to arrest spasm of the glottis, asthma and spasmodic cough attending irritations of the air passages. *Face flushed & warm.*

The heart itself is affected by chloroform; the motor ganglia weaken and their power is eventually lost, and there is a continual fall in the blood pressure. As soon as the corneal reflexes are lost, the blood pressure may sink rapidly, the face turning white and the skin becoming quite cold, the pulse rate falls under normal and the rhythm becomes irregular. The action upon the arteries is much more marked than that of ether, the vaso motor nerves are much depressed, and the vessels may lose their elasticity and become paralyzed. The pulse wave is high, due to this paralyzing action, although the pulse rate is slow and irregular.

~~May be exception. May stand still at first abif~~
Returns in rapids but may stop fresh in
cave & humans.

as an anti acid or NH_4 .

Death may occur at the beginning of narcosis, due to the stoppage of the respiration and circulation. This is purely a reflex action, and may be due to any other irritating vapor, such as ammonia. If the trigeminal and superior laryngeal nerves are cut, this phenomenon does not appear, or only to much lesser extent.

Upon the central nervous system, its first effect is to stimulate, followed rapidly by a marked depression. The peripheral nerves are affected last, and the loss of sensibility to pain is a central, and not a peripheral effect, the same also being true of ether. The official preparations are:

	<u>AQUA CHLOROFORMI</u> containing 1-2% chloroform.	Dose	⁵ 15.000- ¹⁵ 60.000
<i>take as</i>	<u>EMULSUM CHLOROFORMI</u> containing 4%	"	Dose 5.000 15.000 -30
<i>alcohol</i>	<u>SPIRITUS CHLOROFORMI</u> containing 6%	"	Dose 2.000-4.000
	<u>LINIMENTUM CHLOROFORMI</u> containing 30%	"	"

Given by mouth, the dose of chloroform varies from 0.1-1.2 cc., so by remembering this, the dose for the various preparations can be easily figured out.

Uses. Externally, same as ether. Internally may be given in painful affections of the stomach. It is much used as a flavoring agent to cover the nauseous taste of many drugs.

Ether and chloroform are also employed in convulsive disorders due to irritability of the central nervous system where a temporary but rapid depressing action is desired, as strychnine poisoning etc.

Anesthetics cause a descending depression and paralysis of the central nervous system which affects the medulla last and the sensory centres before the motor.

The effect of an anesthetic, like any other drug, depends upon the amount circulating in the blood. They are all volatile at ordinary temperatures, and so are used in the form of vapor. Their absorption, therefore, depends upon what is known as the LAW OF PARTIAL TENSION, which is, that the amount of gas absorbed by the blood is never greater than the volume per cent. of it contained in the inspired air; therefore, the amount of an anesthetic absorbed depends upon the volume per cent. of it contained in the inspired air; that is, if a patient is breathing air containing twenty volume per cent. of ether, the amount taken up by the blood will only be twenty volume per cent. of the air absorbed. If the volume per cent. in the air is now increased to twenty-five per cent., the amount contained in the blood will increase to twenty-five volume per cent. On the other hand, if the amount in the air is decreased to fifteen per cent., the amount in

the blood will decrease to fifteen per cent. In other words, the air taken up by the blood at each inspiration, will contain just the same volume per cent. of ether as that in the inspired air, never more, never less.

There is no selective process in regard to the amount absorbed; it depends upon the concentration of the mixture inhaled, and not upon the amount given. If air containing twenty volume per cent. of ether is given to a patient, that patient's blood will contain, as soon as time enough has been allowed for all the blood to come in contact with the inspired mixture, just twenty volume per cent. of ether, and so an equilibrium will be established between the air inspired and the air in the blood. If the ether in the inspired air is now increased to twenty-five volume per cent., the amount in the system will increase to that; if, on the other hand, it is decreased, the amount in the blood will decrease in just the same proportion.

If a mixture of ether and air containing seventy-five volume per cent. of ether, and twenty-five per cent. of air is needed to produce anesthesia, inspired air containing less of ether than this will not produce anesthesia, no matter how long it is given, for the blood cannot, according to the law, take up a greater per cent. of ether than is contained in the mixture, therefore, at no time will the blood contain enough to produce anesthesia, as the effect of a drug is dependent upon the amount circulating in the blood.

The volume per cent. of a gas circulating in the blood is never greater than that contained in the inspired air, therefore, to produce its effect, the inspired air must never contain less than the required volume per cent.

This is well illustrated by a person coming out of ether. As soon as the cone is removed, the inspired air will contain no ether, therefore, the amount in the system will decrease with each expiration and will keep decreasing until the air in the system is in a state of equilibrium with that inspired. If it is desired to put a patient completely under the influence of ether, again, after he has partially come out of it, the cone must be reapplied and enough ether given until the blood has time to absorb enough to make up the volume per cent. lost while the cone was off.

In order to keep a patient under ether for any length of time after he has been once anesthetized, sufficient ether must be

Ethyl chloride for local anaesthesia

Not ethylene bromide = $C_2H_4Br_2$ No narcotic Post
narcotic changes. Death due in 24° to general collapse

Circulation not affected as much as i chloroform.

Horace Wells 1844.

Colton 1863.

Now used to introduce anaesthesia

given from time to time, in order that the volume per cent. in the blood is never below that required for anesthesia. On this account, the effect of anesthetics is only transitory unless their administration is continued after anesthesia is once produced, as the excretion is as rapid as the absorption after equilibrium is produced.

Air containing only a small per cent. of ether can be breathed indefinitely on this account without producing anesthesia, therefore the effect produced by an anesthetic depends not so much upon the amount given, as its concentration.

As a general anesthetic, the use of chloroform or ether is better taught in the surgical room, than in the lecture room. It may be noted here that complete insensibility is much quicker and more profound with chloroform than ether.

Many substances have been used for anesthetics in the place of ether and chloroform, the principal ones now in use being ethyl bromide and nitrous oxide or laughing gas.

ETHYL BROMIDE is C_2H_5Br a colorless liquid with a powerful odor, soluble in alcohol and ether, practically insoluble in water, boiling at $39^\circ C$. Produces the same effects as chloroform and ether, the difference being that the sensation of pain is lost sooner, and respiration stops at the moment that reflexes are abolished, and therefore it cannot be used to complete anesthesia.

Used as an anesthetic in minor surgical operations where complete anesthesia is not required. Under its influence pain is abolished entirely, although the patient is still able to answer questions. In administering it, the amount to be used should be placed in the inhaler at once, instead of drop by drop, as in the case of chloroform, and the inhaler held close to the face.

NITROUS OXIDE, or laughing gas, is a colorless inodorous gas at ordinary temperature and pressure, and its weight one and one-half times that of air. When inhaled mixed with oxygen in *flushed* proportions contained in air, we see only its intoxicating properties and the sensibility to pain is but slightly diminished. Inhaled pure, its action is very rapid and intense, the pulse becomes quick and full, respiration remains regular and deep, and very soon consciousness is lost, and the peripheral nerves are insensible to pain. All this occurs in about one minute, and passes off in about the same time. In order to produce complete anesthesia, it must be given pure, for when mixed with air only, its

Cannot continue for long time.

Also.

Bromoform.

Methylene chloride.

Ethylene "

Ethyliden "

Various mixtures of ether & alcohol & chloroform. Also pentat.

intoxicating properties are manifest; these are much the same as with alcohol, in ^{coordination} ~~accommodation~~ of movement, sensation of warmth, etc. Upon the central nervous system, its effect is the same as ether and chloroform, first upon the cerebral cortex, and lastly the medulla oblongata, but corneal reflexes may be seen after complete anesthesia. Its action is due to its narcotic effect plus the beginning of asphyxia. It is generally admitted to be the safest anesthetic known. If the action of nitrous oxide is continued, the same general phenomena is seen, as in asphyxia: 1. Pronounced inspiration. 2. Pronounced expiration. 3. A few shallow inspirations becoming fewer and fewer until centre of respiration becomes completely paralyzed. The loss of sensation is present in the second stage, that is, at the beginning of violent expiration. Resuscitation by artificial respiration is always possible during the first part of third stage.

PENTAL, ^{or Amylen.} ^{hydrocarbon} ^{read in H₂O Sol in all} colorless liquid boiling at 36 or 38° C, has been used ^{again} ^{soluble} somewhat within the last few years as an anesthetic. Narcosis lasts only a short time and is incomplete to many subjects. It has never come into general use, and has proved to be much more dangerous to the circulation than chloroform.

HYPNOTICS are substances employed simply to produce sleep. The function of the brain is not entirely paralyzed. In the first stage of the narcosis the susceptibility to external stimulation and the power of attention is decreased. Later the lessened impressions conveyed by outside objects, and the quieting of the abnormally excited centres become more marked, and finally the patient falls into a profound sleep. If the lack of sleep is due to pain, morphine is the best narcotic, but we will now consider only those substances analogous to chloroform and ether.

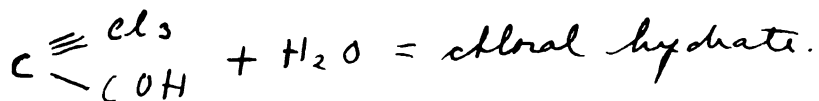
When we use hypnotics we wish them to act for a more or less protracted period, and so have to use substances which are slowly absorbed and slowly excreted. For this reason chloroform or ether are never used to produce sleep ONLY, as they are excreted almost as fast as absorbed, and their action would be only fleeting, but we use substances which are not volatile, but are soluble in water, as watery solutions are absorbed from the stomach slowly and evenly, and then the effects produced by the drugs employed last for hours.

Of all the hypnotics there is only one which is official, all the others being patented, and therefore would not be mentioned in the U. S. P.

Exacted as uric acid

Butyl chloral Hydrate same as chloral
chloral Formamide chloral &
Formamine. Decomposed at
60. Sol in 20 parts of water all
in ether, chloro & alcohol.

chloralosem Glucose & chloral
chlorotomum Acetone & chloral
Hydral Anti pyrene & chloral
Domicil Amilin hydral & chloral.
What chloral & metal.
Sonnet alcohols soln of metal.



CHLORAL, or chloral hydrate, is made from chloral by the addition of water; the chloral takes up one molecule of water, and is transformed into the crystalline chloral or chloral hydrate of the U. S. P. It consists of white crystals soluble in water, ether or alcohol, of a slight aromatic odor, melting at 58° C, and volatilizes slowly when exposed to the air. When triturated with equal amounts of camphor, ^{menthol}thymol, or carbolic acid, it liquifies. It is decomposed by all caustic alkalies, alkaline earths and ammonia. ~~So that it must not be prescribed.~~

Actions. Applied to the skin it acts as a local irritant. The compound with camphor is a valuable anodyne. If taken internally in concentrated form, it causes inflammation of the stomach and intestines, causing vomiting and diarrhoea. When absorbed into the blood it acts as a narcotic. Unfortunately it also effects the blood pressure by depressing first the vaso motor centre, and as a result of this, the walls of the vessels become paralyzed and the blood pressure falls. Later, in larger doses, the heart becomes affected and the pulse rate falls, the respiration also becomes slower, and finally death occurs as a result of the paralysis of the respiratory centre with the stoppage of the heart at the same time.

Upon the central nervous system its action is the same as chloroform and ether. During sleep the pupils are contracted, but become dilated upon waking, differing in this respect from morphine, in which they still remain contracted upon waking. Convulsions are not observed, as the centre of convulsion is paralyzed. The body temperature falls from 0.2 to 1° C as a result of the lessened production of heat. Formerly it was thought to produce its effects by being changed into formic acid and chloroform, but chloral acts as chloral in the blood and never as chloroform. It is excreted in the urine as urochloralic acid which has hypnotic properties, but not as powerful as chloral; there is never any trace of chloroform.

Uses. Externally as a local anodyne, mixed, as a rule, with ^{neuralgia}menthol or camphor. Internally as a hypnotic, but on account of its irritant effect on the stomach, it is better given mixed with a local anesthetic. Given in a watery solution of cocaine, its irritating action will not be felt by the patient. Its main use is as a hypnotic, where the loss of sleep is not due to pain, it being the purest and best one we have. Dose. Two to three grams is the largest single dose given, and not more than five to six

grams in twenty-four hours. As a rule, from 0.8 to 1.0 is perfectly sufficient for adults to produce sleep.

Caution. If the heart of circulatory system is diseased, chloral should be used only with great care. Sudden death after small doses has been observed, therefore, in any case, it is never best to begin with a maximum dose. If gastric or intestinal disturbances are present, it should not be given as it may cause very disagreeable results.

On account of the dangerous symptoms which chloral may produce, many substitutes have been employed, but none with good results. Compounds of chloral and other substances, such as hypnal, somnal, ^{ural}, chloralos, chloralformamid or chloralide have been tried. Hypnal is a mixture of chloral and antipyrin. Somnal is chloral and urethan. Chloralos is chloral and glucose; chloralformamid is chloral and foramide. None of these have any advantage over chloral, and some are not even so prompt in their hypnotic powers.

At the present time six other hypnotics are very much in use. Three of them, urethan, amylenhydrate, and paraldehyde, are ^{non-}halogen compounds. Trional, tetronal and sulphonal are sulphur compounds. The narcotic action of all these is practically identical to chloral hydrate.

Urethan consists of white crystals soluble in water, alcohol, and ether, having a pleasant saline taste. It has no particularly bad influence on the circulation or respiration, and, in fact, may strengthen a weak respiration.

In special diseases where the respiration is weak, it is the best hypnotic to use, but unfortunately it is not very powerful, and may fail to produce its effects in some cases. Dose from two to three grams, best given in a single dose. If this does not act, neither will a larger amount.

Paraldehyde is a liquid of a peculiar penetrating odor, freely soluble in alcohol and ether, and in ~~eight parts~~ ^{of} water. It does not affect the circulation or respiration in doses sufficient to produce sleep, and, as a rule, acts quickly.

Its disadvantages are that on account of its peculiar smell, it is repugnant to some and may prohibit sleep, and also that it can only be used for two or three nights, losing its power as the patient becomes accustomed to it. Dose, three to five grams best given in single doses. *Maximum 8 gm in 24 hrs.*

Amylenhydrate is also a liquid, colorless and more oily, pe-

Hedonal $\frac{1}{2}$ to 2 gms. dose. Sol in 150 H₂O & in all.

Hyponum sol to 20°C above yellowish liquid. Smell & taste of bitter almonds.

Veronal formed this year.

Amyleni Hydrate 1.0 - 2.0

Dominol, new but n.g.

culiar odor, solubility exactly the same as paraldehyde. In other respects it is practically the same as paraldehyde. Dose, two to four grams best given in a watery solution.

Suphonal, trional and tetronal are all white crystalline substances, and contain sulphur. The hypnotic powers of all three are about equal to chloral hydrate. They have no bad influence upon circulation or respiration. The narcotic influence of suphonal is rather slow, as it is soluble in water with difficulty requiring five hundred parts, therefore, its absorption will be slow and its action long in being brought on, but continuing for a long time. *So given as a powder. 2 hrs before bed in wine hot*

Trional and tetronal are somewhat more soluble, in ²⁰about three hundred parts of water, and so their influence will be felt sooner than that of suphonal. ~~Dose 1-2 g.~~

All these substances are fairly soluble in alcohol and hot water, and for this reason are best given in a mixture of water and whiskey or brandy, or in hot drinks such as tea or coffee. Dose from one to two grams.

When used for a long time, toxic symptoms closely allied are observed, such as headache, nausea, dizziness, incoordination of movements, difficulty of speech and diarrhoea, followed by irritation of the kidneys. This is due to the fact that they are not broken up in the system and are eliminated unchanged, hence the reason for the change in the kidney.

To avoid these toxic effects, give in the doses mentioned for only three or four days, and, if at the end of this time narcotics are still necessary, use one of the other group alternating in this manner as long as hypnotics are necessary; by so doing you will avoid the accumulation of any one drug in the system and production of the undesirable results.

MORPHINE is the one hypnotic when the loss of sleep is due to pain. It is one of the alkaloids of opium. Opium is a milky exudation from the unripe capsule of the *Papaver somniferum*, or white poppy. Crude opium may contain from six to twenty-three per cent. of morphine, as well as eighteen other alkaloids, some of which have an entirely different action from morphine, some having no action, others having the same action but being much weaker. The proportion in which the alkaloids are contained in opium varies much, depending largely upon the country from which it is exported. Crude opium, according to the U. S. P., should contain 9% morphine. Cold blooded animals are not very suscep-

tible to the action of morphine, so that larger doses have to be used to produce its effect. Warm blooded animals are much more susceptible, and for this reason we will study its effects upon a dog in order to understand better how it acts upon human beings. We will inject only a small dose, for if we use a large dose the secondary results happen so quickly that we will not have a chance to study thoroughly its first action. Loss of sensation to pain & fear is first noticed, but the reflexes remain normal. This happens before any of the constitutional affects are noticed; later the dog becomes drowsy and soon falls into a profound sleep. Vomiting generally occurs, and this will give me an opportunity to demonstrate one of the peculiarities of morphine which is very generally overlooked. About 50% of the morphine injected subcutaneously is excreted into the stomach in the following forty or sixty minutes, beginning two or three minutes after injection, so that in poisoning by morphine the stomach must be washed out repeatedly until the wash water shows no trace of morphine. Emetics are not very useful as often they will not cause vomiting on account of the depressed condition of this centre. It is also excreted in the faeces in quite large amounts (about 40 per cent.) but only slightly in the urine and sometimes not at all. This is well illustrated in the following case. The urine from a woman who was taking over a gram of morphine per day was collected for a month, and when examined, no trace of morphine could be found. In cases of poisoning by morphine the faeces and not the urine should be examined.

Upon human being it acts first, in diminishing the susceptibility to sensory stimuli, especially those causing pain or cough. There may also be an excitant action for a short time, causing an exaltation of feelings; this is however quickly followed by the constitutional action, and the patient becomes drowsy, and profound sleep rapidly follows.

Morphine does not affect all the higher centres alike, some being more affected than others. In one case we may have loud talking, and in another incoordination of movements. By and by all the higher centres become depressed, and narcosis becomes deeper, so that the subject does not respond to stimulation, light or sound.* Upon awaking, some feel nauseated while others are perfectly well.

In some persons the reflex irritability may be more increased, this however happens but rarely. It is much more frequent in the lower animals.

* Shaking vigorously will rouse the patient.

Fluid extract = Prep. of organic drugs made by dissolving drugs & concentrating the fluid by evaporation until 1 cc of the fluid equals 1 cc of the drug.

Extract = A solid or semisolid substance made by evaporating an organic compound to the required consistency

Rx Pulvis Opii 0.05
Sacchari Lactis 0.3
^{an} Fiat pulvis. Denture doses tales vix
Sig t.i.d.

If the dose is large enough the sleep becomes so profound that the person cannot be aroused, and complete unconsciousness follows with deep coma, death being due to stoppage of respiration.

It acts first upon the brain, and later the medulla, especially the respiratory centre, the respirations becoming fewer, weaker and irregular. This was demonstrated upon a rabbit, the breathing became much slower and at last stopped entirely. Local applications of morphine have no effect, neither motor nor sensory nerves show any influence. Applied to mucous membranes or raw surfaces it will be absorbed, but acts then only through the blood the same as when injected subcutaneously.

The action upon the heart even in quantities sufficient to cause complete narcosis is not marked. The superficial vessels, especially those of the face, dilate, but this dilation is not sufficient to cause a fall in blood pressure. If used in toxic * doses, there may be a paralysis of the heart the same as with chloroform and thus a drop in blood pressure, but otherwise it is nearly normal.

Upon the intestines it acts by diminishing peristalsis, lessening the number of stools and may cause constipation. How this action is brought about is not known; whether the paralyzing effect is central or local, there is no positive proof. Some people get an itching of the skin, which is probably due to the dilation of the superficial vessels. Body temperature is lowered, probably due to more heat dissipation on account of same dilation.

All of the secretions of the body, with the exception of sweat are decreased. To some slight extent, ^{10%} morphine becomes oxidized in the system forming oxydimorphine, but for the greater part is excreted unchanged, principally in the faeces.

In most cases the pupils are contracted; how this is brought about we do not know. If applied locally it does not cause this, so that it must be brought about by some central action.

Official preparations: --

PULVIS OPII contains 13-15% morphine. Dose, 0.05-0.15 grams. ^{0.2-1.0 grains}
As much as 0.5 gram may be given with safety in twenty-four hours.

PULVIS IPECACUANHAE et OPII (Dover's powder) contains 10% opium and 10% ipecac, the rest is simply sugar of milk. Dose, ~~0.2~~ 0.2-0.6 grams.

⁵
EXTRACTUM OPII contains 18% morphine. Dose, 0.01-0.0⁵; 0.4 gram in twenty-four hours.

* Grande

Tincture = An alcoholic solution of the soluble constituents of drugs which are not volatile. (Tr of Volatile is volatile).

Vinæ opii is white wine like tincture

Rx Tincturae Opii 20.0
Tincturae Scutellariae 80.0
m

Alkaloids sol in alk but not in H₂O
Salts sol in H₂O but not in alk,

Rx Morphinae Sulphatis 0.01
m. Fiat pilula, Dentum
does take no X.

TINCTURA OPII, or LAUDANUM, containing 10% opium. Dose, 0.500-1.500; 5.000 in twenty-four hours. *Morphine 1 1/2 gr*

TINCTURA OPII CAMPHORATA, or PAREGORIC, contains 4% opium and same per cent. camphor, benzoic acid and oil of anise. Dose, 4-15 grams.

We know positively that morphine is not absorbed unless the skin is broken, so that the use of liniments is perfectly irrational as are fully sixty per cent. of all the official preparations, so that the five given are sufficient for all practical purposes.

Of morphine, there are only two salts. *to 2 - 0.3*

Morphine sulphate, soluble in ²¹~~two~~ parts of water, *best in alk* morphine hydrochlorate, soluble in twenty-four parts of water.

Both are white crystalline substances. Dose, 0.008-0.030. *0.44 - 24 hr*

Uses of Opium and Morphine. Local applications to unbroken skin is irrational as it is not absorbed. The rational indications for their use may be classed under four heads: 1. Suppression of pain or other sensory irritation such as cough etc. 2. Hypnotic. 3 To suppress convulsions and other motor excitations. 4. To suppress diarrhoea and other pathological increased secretions, with the exception of sweat.

It is sometimes used in tetanus, but as you know that morphine sometimes causes reflex irritability, it is preferable not to use it where there is irritation of the spinal cord.

Cautions. Morphine should be used cautiously in children, as they are very susceptible to the drug. On account of its very depressant action on respiration use carefully in pneumonia.

The respiration is weakened by morphine, even in the minutest trace (0.001-0.002 grams in cases of pneumonia). It should not be given in chronic troubles, only in acute, for if given in chronic diseases the habit is very apt to be formed. Heart or kidney disease are not contraindications to its use, as it does not affect the circulation.

Generally, in the administration of morphine, use it in sufficiently large single doses to get the desired effect, small and repeated doses are not practicable. If the rapid action is required, use one of the chemically pure salts of morphine injected subcutaneously. In diarrhoea or intestinal troubles, give opium, as it is absorbed slowly, and therefore its action will be continuous. Chemically pure morphine is absorbed very quickly.

HEROIN or Diacetylmorphine is synthetically prepared and is a white crystalline substance of a slightly bitter taste, practically insoluble in water but readily soluble in dilute acid solutions, especially acetic. It is used as a substitute for Codeine especially in affections of the respiratory tract complicated by an irritating cough. Dose 0.003-0.010.

DIONIN or ^{Ethylmorphine} ~~Ethylmorphine~~ ^{or hydrochlorate} is also synthetically prepared. It is a fine white crystalline powder very soluble in water and is said to have the narcotic effects of morphine but is somewhat less powerful. Like Heroin its principal use is in respiratory affections where there is an irritable condition of the bronchial mucous membrane. Dose 0.015-0.120.

Heroin and Dionin affect the alimentary canal less than Morphine and have less disagreeable after effects. For this reason and because of their marked action as respiratory sedatives they have been much used since their introduction a few months ago, to check troublesome coughs.

Heroin has been longer in use than Dionin and several cases have been reported when severe untoward symptoms have followed its administration so that at present it is used to a much less extent than in the beginning. Less is known about Dionin and as yet no bad results have been reported so that at present it seems to be a safer substitute for Morphine than Heroin. *Depresses respiration.*

Morphine

Don't use Heroin at all

It has not been used.

$\frac{1}{2}$ *Codinae Sulphatis* 0.02
Sacchari Lactis 0.3
~~in~~ *Trat. Fleris*. Dentum donec
 talis no. X.

Lactuca virosa sub. for morphine
Piscidia erythrina etc for dog wood also
Pellote (from Mexico) little used substitute.

methyleuorphine.
CODEINA is the only one of the other 18 alkaloids of crude opium which has found use in general medicine. It is a white crystalline substance soluble in eighty parts of water. More soluble are two of its salts, the sulphate and phosphate, the sulphate being the one generally used. *in 4% water.*

The action of Codeina upon the intestines is not powerful, and unlike morphine is not apt to cause constipation, as it does not check the secretions. Neither does it check the secretion of the respiratory tract and so is much used in troublesome cough. It stimulates the spinal cord more than morphine and its depressant action upon the brain is less marked and so is more likely to produce reflex irritability, if used in large doses. The ordinary dose however is not sufficient to cause this. It is used in cases of excessive and bothersome cough such as in phthisis and bronchitis, does not check the secretion and so its use is rational and as there is much less danger of contracting the habit, its use in chronic diseases, especially in phthisis, is much more preferable than that of morphine. Dose ~~0.02~~ ^{0.1} 0.1 as much as 0.4 in 24 hours.

Morphine or Opium are not to be used for long periods on account of the danger of contracting the habit. In former times two other drugs have been used to produce the same results. The first, CANNABIS INDICA or Indian Hemp, is the flowering tops of Cannabis *(Hemp)* Sativa. In the far East this drug is used extensively. It is made up in different forms of confection and sold under the name of Hashish, and is not only eaten but also smoked and in the form of drinks in much the same manner as alcohol is here. When taken it is characterized by deep intoxication; the person may talk loud and is perfectly happy. Following the preliminary exaltation is the depressant action. The subject becomes sleepy, his limbs feel heavy, and the general sensibility is decreased; finally, deep sleep sets in same as other narcotics. As a rule, on awakening, no unpleasant after effects, but if the drug is used continually, the same symptoms may be present as are seen in opium fiends. Its narcotic influence is due to cannabinon, an amorphous bitter resin. Besides this there are two other alkaloids, one, volatile, and the other the crystalline tetanocannabin, which produces tetanus, or convulsions, like thebaine. The U. S. P. contains two extracts and one tincture. The quantity of active principle varies very much in the crude drug, therefore, it is impossible to give an exact dose when you do not know the amount contained in the crude drug, consequently, begin with a small dose, gradually increased if need be.

Ext Cannabis indica fl. 0.1 - .5

Astringent = an agent producing contraction
of organic tissues or arrest of a discharge

ALCOHOL = *ethy alcohol* paralyzes the central nervous system after absorption in the manner of ether or chloroform. We must distinguish between the Local and the General action; the latter is produced after its absorption into the system.

LOCAL ACTION. When applied to the skin alcohol evaporates quickly, producing a cooling effect and the skin turns white on account of the contraction of the superficial vessels. If the evaporation be prevented the local action becomes more marked causing an irritation with a resulting dilatation of the superficial vessels, and redness, itching and sensation of heat. On ulcerated surfaces and mucous membranes the irritation is more marked and may produce inflammation. If concentrated solutions are used the albuminous matter of the tissues is precipitated but not coagulated. Only after long contact with albuminous material is the latter coagulated by alcohol. When alcohol is left in contact with mucous membranes for a long time the local action becomes astringent and even corrosive, and may lead to an increase of interstitial tissue.

use brandy or whiskey
INTERNALLY concentrated alcoholic solutions produce a feeling of warmth and even a sensation of burning. The secretion of saliva is increased and the pulse is quickened due to a reflex action consequent on local irritation. Effects seen at this moment cannot be due to absorption since none of the alcohol had been absorbed. The local irritant action in the stomach causes an increase in gastric secretion and also increased peristalsis. Like many other substances when taken into an empty stomach it may cause a sense of hunger. In concentrated form alcohol produces reflexly through its irritant action on the mucous membrane of the stomach, dilatation of the superficial vessels of the face with consequent flushing and acceleration of the pulse. Sometimes the pulse wave is raised and the respiration increased. All the actions enumerated above are produced reflexly. *before absorption.*

GENERAL ACTION; as soon as alcohol is absorbed into the blood it acts like the other narcotics, differing in its paralyzing action only quantitatively not qualitatively. To produce the same quantitative effects as ether and chloroform, very large quantities of alcohol must be used. If sufficient alcohol is introduced into the system death will be produced by paralysis of respiration. The action upon the heart is not marked except in toxic doses which paralyze the heart muscle. The dilation of the superficial blood vessels is caused by the depression of the vaso-constrictors and may cause a higher pulse wave, but the blood pressure is reduced. Al-

Brandy 50-55% Alcohol.

Beers 4 1/2

Alks 6-8

Wines non-fortified 10-14

fortified 14-25

Caffeine in acute case of poisoning.

cohol in concentrated form is rapidly absorbed from the stomach and blood rich in alcohol will reach the liver. This fact may account for the pathological changes in the liver from its continued use. Large amounts of concentrated alcohol not only produce cirrhosis of the liver but also cirrhosis of the stomach with complete atrophy of all the gastric glands. Kidney troubles are not likely to result from its use because it reaches the liver first and produces its results and by the time it reaches the kidneys it is too dilute to have any action.

USES OF ALCOHOL, Applied externally to sprains, bruises, etc., to check inflammation by means of the cold it produces on evaporation. The Astringent effect is used as a preventive to bed sores and cracked nipples. To Stimulate the Skin in general alcohol is rubbed in. It penetrates the skin and causes a dilatation of the superficial blood vessels causing an increased flow of blood to it.

The Reflex Stimulation of the respiration and circulation is used in cases of fainting. Internally it is used as a gastric stimulant. No special rules can be given for such application; in general one may say if the patient improves under the application of alcohol it may be continued if not it should be discontinued. In this matter both subjective and objective symptoms should be considered. *Not a cardiac stim. but quiets nerves.*

The Narcotic effects may be of value in nervous conditions such as sleeplessness and general nervous irritability. How much the ethereal oils contained in wine and other alcoholic beverages help to bring about the narcotic effect is an open question, but their influence is probably great. Under its administration the body temperature falls and is due to the dilatation of the superficial blood vessels.

The fate of Alcohol in the System. After absorption it is oxidized in the system, only about 4% being excreted unchanged by the kidneys and lungs. The products of oxidation are not found or only to a limited extent in the waste products of metabolism therefore it must give up energy to the body during the process of combustion.

The general opinion of pharmacologists is that alcohol taken internally cannot replace the proteid material of the food, but if sufficient proteids are present in the food alcohol can replace the carbohydrates or fats entirely. If the food contains sufficient proteid material, carbohydrates and fats, alcohol is stored up in body as adipose tissue. Official preparations are:

ALCOHOL (91% pure.)

ALCOHOL ABSOLUTUM. (99% pure.)

ALCOHOL DILUTUM. (41% pure.)

SPIRITUS FRUMENTI. (40-50%.) *whiskey*

SPIRITUS VINI GALLICI. (40-50%.) *brandy*

4 these

LACTUCARIUM, the milky juice of *Lactuvirosa*. It has been used for a long time in the Indies to narcotize fishes. Its active principle is unknown, *symp 5-15* and ~~less do we know about~~ Jamaica dogwood or piscidia erythrina. *active resin. Fl. ext.*

Syn. 15
PELLATINE, the alkaloid of pellate, a Mexican drug of only two or three years old, has been used somewhat lately to produce sleep in nervous patients, in dose of 0.06 sleep followed in about two hours. Whether this drug may find more practicable use is yet to be seen. Bad results may follow its use, as marked collapse has been noted following the use of only 0.1 gram. It is used only subcutaneously.

amplified
NITRITE OR AMYLNITRITE GROUP. These are a few drugs classed into a group because of similarity of action. Besides these we have also to consider Ethyl Nitrite, Nitrite of Sodium and Nitro-Glycerine. The general action of the substances belonging to this group are briefly as follows;

Dilation of the smaller arteries of the skin, and as a consequence we notice in human beings a flushing of the face and to some extent of the body, thus producing a sensation of heat, the blood pressure begins to fall and in consequence the heart beats more rapidly and the pulse rate increases, by and by the internal vessels dilate also, and the blood pressure falls rapidly and perceptibly. This dilation of the blood vessels is partially due to a depressant action of these substances on the vaso-motor centre and partially to a direct action on the arterial walls.

All the substances of this group have a narcotic action upon the central nervous system, and of course the body temperature but only slightly, as a result of this action on the vaso-motor centre.

If large quantities are taken, nervous phenomena are very often observed, especially giddiness, general restlessness and very often a disturbance of vision, even in medicinal doses consciousness may be lost. The respiration is hurried under the influence of these drugs, probably due to the change in the circulation.

All these drugs if taken in large doses, especially nitrite of sodium and nitro-glycerine, produce characteristic changes in the blood which consists in the formation of methemoglobin which has the same chemical formula as oxyhemoglobin but shows different absorption bands in the spectroscope. The peculiarity of methemoglobin is that it does not give up its oxygen readily so that signs of

Rx Spiritus Aetheris Nitri 20.0
 Spiritus Fummenti 50.0
~~m~~ Liq. 3i tid.

Rx Sodii Nitritus 4.0
 Aquae ad 150.0
~~m~~ Liq. 3i tid after meals

asphyxiation may be shown, differing markedly in this respect from the oxyhemoglobin.

If a dog be made to inhale large doses of sodium nitrite he will become entirely narcotized, but in a short period he will become restless and the respiration will become slower and slower and finally stop. Nitrite of Sodium in doses of 0.3 gram has caused signs of asphyxiation to be shown.

In man inhalation of nitrite of amyl causes a short dry cough, followed almost immediately by flushing of the face and throbbing of the carotids, a feeling of fulness or tension in the head, and a rapid and fuller pulse, and if the patient is standing up there will be a muscular relaxation. The flush not only covers the whole face, but may extend to the breast, and sometimes much lower. The pulse may rise from seventy-two or seventy-four to 120 to 140 beats per minute. In large quantities there may be a loss of consciousness.

Official preparations belonging to this group are:

ETHYL NITRITE. *alc. sol. a comp.* It is not used chemically pure, but in the form of spiritus aetheris nitrosi, or sweet spirits of nitre, which is an alcoholic solution of ethyl nitrite and water.

It is a clear, volatile, inflammable liquid of a pale yellow tinge, ethereal, slightly pungent odor, and decomposes very readily and therefore its composition is not very constant, especially if exposed to direct light. U. S. P. says it should contain twenty-two times more alcohol than ethyl nitrite. The action of this is very mild. Dose, ~~1-300-4.000~~.
2-6 1-5

AMYL NITRITE is a clear yellow liquid, very volatile, and contains about eighty per cent. of amyl nitrite, the remainder being by-products formed in its production whose chemical constitutions are not known.
.1 - 1.0 cc qd 2 - 5

It has a sweet, fruity, penetrating smell, and is ~~almost in-~~soluble in water, but is miscible in almost all proportions with alcohol. It is generally administered by placing three or four drops on a handkerchief and inhaling the fumes.

SODIUM NITRITE. A white crystalline body very deliquescent, very soluble in water (1-2 parts), slightly in alcohol, and of a saline taste. Dose, ~~0.1-0.3~~ grams.
.1 - 0.3

NITRO-GLYCERINE. The official preparation of this is an alcohol solution of the substance called glonoini, forming the

Glycerine tri nitrate.

In sol. or pearls. or tablets. or pills

spiritus glonoini of the U. S. P. and containing one per cent. by weight of nitro-glycerine. It is a clear liquid having simply the taste and odor of alcohol. Dose, ~~0.00-0.1~~ ^{0.05 - 0.1} grams. *get i-ii*

Uses. The whole group is used in cases where the contraction of the vessels is the cause of the trouble, such as angina pectoris, nervous asthma and epilepsy. The action of amyl nitrite is so quick that the relief obtained will be only temporary.

Instead of amyl nitrite we may use the alcoholic solution of nitro-glycerine or sodium nitrite, the actions of which are claimed to be better. Sweet spirit of nitre has no strong action, and is only used to produce dilation of the vessels in cases of simple cold.

Caution. Do not use these drugs for a long time, or in large quantities, as the change which they produce in the blood are undesirable. Nitro-glycerine causes severe headache even in very small doses.

HCN

HYDROCYANIC, or Prussic Acid, is a gas prepared from the cyanides by the action of acids. For medicinal purposes, a watery solution containing two per cent. by weight of absolute hydrocyanic acid is used. It is a colorless liquid of peculiar odor, very volatile and decomposes easily. Those cyanides which are decomposed in the system have the same action as the free acid. The official salts of hydrocyanic acid are hydrocyanide of potassium, which consists of white crystals, soluble in two parts of water. These are decomposed in the system and so have the same action as the free acid. Ferrocyanide is the only other official salt. It is not decomposed in the system, and so is not used in this form to take the place of the acid. *not fatal*

Cyanide of zinc and silver are used in other countries to some extent.

Hydrocyanic acid in its free state is found in combination with a number of organic acids which compounds are called amygdalin, and which, under the influence of the ferment emulsin from the bitter almond, set free the acid. Cases of poisoning from ingestion of these vegetables, as well as from bitter almonds, which contain both the compound and the ferment, have been reported.

*

Symptoms of poisoning by hydrocyanic acid are feeling of tension in thorax accompanied by rapid breathing, soon the respiration becomes much slower and palpitation of heart sets in accompanied by

Sense of pain is lost before the respiration becomes lower

Death due to paralysis of respiration center.

great fear and muscular weakness with headache and giddiness. If larger quantities are taken consciousness may be lost very rapidly and the subject fall to the ground suddenly; very soon trismus* and convulsions are seen, the respiration becoming irregular and even ceasing entirely for longer periods, the pulse becomes frequent and very small, and at last the subject becomes comatose, the respiration and circulation gets weaker and finally cease altogether. After very large doses death may follow in one minute or less.

About 0.05 grams of the absolute acid has proved to be a lethal dose, although larger doses have been taken and the subject has recovered. Its action upon cold blooded animals is not so powerful or marked as in warm. In man and warm blooded animals death is due to paralysis of the respiratory centre, and at the same time the blood has undergone a change, the oxyhemoglobin of the blood combines with cyanic acid forming cyanohemoglobin, which is quite a stable compound, and does not part with its oxygen readily. *but takes it before hand.*

Actions. Applied locally to the skin it depresses the nerves and is sometimes used largely diluted to relieve itching when the skin is unbroken.

Internally it is used as a gastric sedative acting in the same way upon the nerve terminations in the stomach, and is also used in cough mixtures on account of its depressing effect upon the centre of respiration, but it is better not to prescribe it at all, and at present as a rule less dangerous drugs are used.

Its action upon the central nervous system is at first a stimulating one, lasting however for a very short time, which is followed by the powerful depressant effect, affecting all the centres; heart, vaso motor and respiratory. The peripheral endings of the nerves as well as the centres are paralyzed.

In cases of poisoning stimulation should be used, especially artificial respiration. Successful cases of recovery have been reported where the respirations have fallen as low as two per minute.

The official preparations are *2% KCN by wt. Not used*
Watery solutions of HYDROCYANIC ACID, Dose 0.05-0.35 grams.

CYANIDE of POTASSIUM. Dose 0.006 grams. Besides these the U. S. P. contains several crude preparations which contain hydrocyanic acid such as

OIL of BITTER ALMONDS,

* *Convulsions of face.*

Usually used in cough mixtures simply
as flavoring agents.

Rx Ammoniae Carbonatis 4.0
Syrupus Pruni Virginianae 40.0
Aqua ad 100.0
~~Am~~
Sig. Zi. 4. i. d.

WATER of BITTER ALMONDS, *Aq. amygdalae amara.*
 EFFUSION of BITTER ALMONDS, *Singl 4-15 cc*
 SYRUP of WILD CHERRY. *Sy. Prunus Virginiana*

In prescribing the above the fact of their containing this acid should always be taken into consideration.

AMMONIA (NH_3). Pure ammonia is a pungent, irritating gas. It is not used in this form in medicine, but as watery solution or in the form of some of its salts. Its local action is to produce irritation and if evaporation is prevented it produces vesication. Upon mucous membrane this effect is very marked and if inhaled it produces irritation of the nose, watering from the eyes and if prolonged, irritation of the bronchi.

If the strong liquid be swallowed it may cause not only irritation of the oesophagus and stomach but also necrosis.

Reflexly it stimulates the circulation and respiration, the blood pressure rises and the breathing increases.

If injected subcutaneously or directly into the circulation direct stimulating effects are noticed and the medulla and spinal cord becomes very markedly stimulated, the respiration and circulation are much increased and the blood pressure rises rapidly. In large doses convulsions may be seen resembling very much those seen in strychnine poisoning and sometimes tetanus is produced.

When taken internally the urine does not become alkaline, as it is transformed into urea in animals and uric acid in birds.

The following are the different forms in which it is used:

AQUA AMMONIAE. A watery solution containing 10% of the gas.

AQUA AMMONAE FORTIOR. Containing 28% by weight of the gas.

AMMONII CARBONAS. *Ammonia elementum.* A crystalline substance which loses ammonia (CO_2) when exposed to the air. Soluble in five parts of water. Dose, 0.100-1.000. *g*

AMMONII CHLORIDUM. Crystalline salt, soluble in three parts of water. Dose, 0.100-1.000.

SPIRITUS AMMONIAE AROMATICUS. Contains ammonia carbonate, ammonia water, *+ alcohol.* and three or four volatile oils. Dose, 2.-8.

Uses. As a local irritant for counter irritation. By COUNTER IRRITATION, we understand any irritation artificially produced to remove or diminish certain morbid processes which may be going on in the deeper structures.

Its reflex action on the respiration and circulation is made use of by simply taking a few whiffs of ammonia.

To increase bronchial secretion the carbonate ~~or~~ chloride is used, as it is partially excreted by the bronchial epithelium, and thus serves to render the mucous less sticky and tenacious, and therefore more easily expectorated.

To increase the respiration and circulation, ammonia should not be given by the mouth, as it may not be absorbed on account of its irritating effect, but should be given subcutaneously or by inhalation, when its action is rapid and powerful.

Caution. Patients should never be allowed to inhale it too long, as it may cause inflammation of the whole of the respiratory apparatus and undesirable results will be produced.

STRYCHNINE GROUP. Belonging to this group, besides the alkaloid strychnine, are the alkaloids--Brucine, ~~Calabine~~, Tetanocannibine, Thebaine, Gelsemine. *calabarine*

Strychnine and brucine are extracted from the seeds or beans of *strychnos nux vomica* and *strychnos ignati*, an East Indian tree. *2 1/2 - 57, 1 - 37.*

CALABARINE is one of two alkaloids derived from calabar bean, the other eserine or physostigmine.

TETANOCANNIBINE is extracted from Indian hemp.

THEBAINE is one of the many alkaloids of opium.

GELSEMINE is extracted from the yellow jasmine or *jelsemium sempervirens*.

They all have a very strong bitter taste which is noticeable with strychnine even when there is only one part to 750,000 parts of water. Strychnine is the only member of this group which has any practicable interest as it is the only one which is used to any extent in medicine; it has no local action. When injected subcutaneously or applied to mucous membranes, it is a local irritant. It stimulates the mucous membrane of the mouth, causing increased flow of saliva, and locally stimulates the nerve endings of the stomach and intestines. There is an increased desire for food, and in small doses strychnine is much used as a stomachic, also causes increased peristalsis. Large quantities will cause nausea and vomiting, and sometimes diarrhoea. Strychnine stimulates the whole central nervous system, and especially are those centres influenced which are stimulated from nerve end-

ings, such as smell, taste, touch, sight, etc. The blood pressure rises on account of the stimulation of the vaso motor centres and contraction of the smaller arteries. The pulse rate is decreased on account of the stimulation of the vagi. The respiratory centre is stimulated, causing increased respiration. The rise in blood pressure is due to the direct action of strychnine upon the smaller arteries as well as upon the vaso motor centre, and is proven by the fact that there is a rise in blood pressure even when the cord is severed in the cervical region. Strychnine is a powerful stimulant to the spinal cord, and convulsions may result. External stimulation is necessary to produce these convulsions as they are due, not to a stimulation of the peripheral nerves, but mainly to the increased reflex irritability of the cord. This is proved by the experiment in which the motor nerves of one leg are severed and the femoral artery of the other leg is tied, the nerve of this leg remaining intact. No convulsions are seen in the leg in which the nerve was severed, but are found in the other leg in which the artery was tied. Convulsions are also produced, even after the head is severed, thus proving their spinal origin.

In human beings, if too large doses are given, there is first noted a tension in muscles of the neck gradually extending over those of the rest of the body and tetanic convulsions may be the result of a slight touch or even the taking of a deep breath. These symptoms disappear quickly, leaving the patient with pain in the muscles and quite weak. If now a very small additional dose is given more intense convulsions are produced showing the accumulative properties of these drugs. In fatal doses until almost the last convulsion the patient is conscious and mind is perfectly clear. As a result of this there is great pain and anxiety making the whole a very painful sight. The convulsions last from one to two minutes with more or less interval between but if a slight irritation is applied to the body during this interval, sometimes only a draft, another convulsion will immediately occur. Time between recurrent attacks becomes shorter and shorter and finally the patient loses consciousness and dies in a violent paroxysm as a result of asphyxiation. Strychnine also has a paralyzing action on certain centres, but this is seldom seen as it is usually masked by its convulsive one. Sometimes, however, when excessive doses have been taken, the heart is found to beat with an increased rapidity and with lessened force, and death results from general paralysis due to this action. Rabbits are especially susceptible to this drug, even a moderate dose produces only

Hydrochlorate of Stiel .001 - .01 - .02 in 24 hrs

one or two convulsive movements and death rapidly follows, due to this paralyzing action.

Strychnine is very slowly excreted with the urine as such this probably accounts for its accumulative action, the effects lasting for some time after the administration has been stopped. This accumulative action should be always taken into consideration where it is intended to be administered for a long time. On account of its stimulating effect upon the heart it is used where an extra amount of work is thrown upon it and is threatening to give out as in pneumonia. It is also valuable in pneumonia on account of its action in strengthening the respiration. It is used to quite an extent in catarrh of the stomach and intestinal tract and other digestive derangements especially where their origin is supposed to be due to the innervation. It increases peristalsis and therefore is used in constipation. In long standing motor paralysis where the conductivity is not impaired very beneficial results are sometimes obtained. It is however in the subacute or chronic cases due to alcohol or lead poisoning where its value is most marked. It should never be given in recent paralytic conditions but only in those which have lasted for some time.

In convulsions from strychnine, chloral is administered by the mouth if possible, but if the patient is very sensitive, it may be necessary to first give ether, and then administer the chloral by rectal injection.

Strychnine as a chemically pure alkaloid is used in the form of sulphate and hydrochlorate.

STRYCHNINAE SULPHAS. White needle-like crystals, soluble in fifty parts of water, is commonly used. Dose, 0.001-0.010, either by the mouth or subcutaneously, and not more than 0.020 should be given in twenty-four hours.

The most important of the crude preparations are

EXTRACTUM NUCIS VOMICAE. Dose 0.010-0.¹⁵~~015~~ and not more than 0.150 per day. ²⁵~~26~~

EXTRACTUM NUCIS VOMICAE FLUIDUM. Dose 0.050-0.²⁵~~250~~.

TINCTURA NUCIS VOMICAE. Dose 0.300-1.²⁵~~200~~.

For the stimulation of heart and respiration it is best to use the chemically pure salt; for other conditions some of the crude preparations,

Caution. If your patient complains of stiffness or soreness of

the muscles of the neck, stop the administration of your drug at once as this is the first symptom of its toxic action.

ATROPINE GROUP. To this belong the different drugs extracted from Salanacae or Deadly nightshade. These drugs are only chemically related. They are ethelial compounds of one or two bases with organic substances. So far as is known they all contain the base Tropine or the base Scopoline in combination with some organic acid. The most important alkaloids of this group are

ATROPINE⁽⁴⁾ and BELLADONINE extracted from the leaves and roots of Atropa Belladonna and seeds of Datura Stramonium. The alkaloid Datropine is identical with atropine.

HYOSCYAMINE^(p) obtained from the flowering tops of Hyoscyamus Niger. *acts as a narcotic*

HOMATROPINE⁽⁴⁾ is synthetically prepared.

SCOPOLAMINE is an alkaloid obtained from the broom plant. *Scropulariaceae*

Mixtures of the different alkaloids have received various names but are not chemically pure substances. All the substances of this group have a more or less similar chemical characteristic. They differ more in strength than quality. In practical medicine we make use of atropine, hyoscyamine and homatropine.

It acts both as a stimulant and depressant to the central nervous system, stimulating the cardiac and respiratory centres and depressing the others.

Upon the peripheral nerves the action of these drugs is a depressant; especially is this marked upon the nerve endings of those organs composed of unstriated muscular fibres, such as uterus, bladder, intestines, etc. They all have a bitter taste. When taken into the mouth, they first cause an increased flow of saliva, followed by a decrease which causes dryness of the mouth and pharynx, a creeping and stretching sensation in the throat, and difficulty in swallowing. This is due to the temporary stimulating effect followed by the marked depressant one upon the nerve terminations. The terminal nerve endings in the bronchial tubes are also depressed; this means a lessened bronchial secretion. Whether the secretion of the digestive juices is decreased is not known, but it probably is. It depresses the nerve endings of all true glands, such as mammary, salivary, etc., and as a result the secretions are much lessened, or altogether stopped. The sweat glands are paralyzed, and as a result the

skin becomes dry and hot, and sometimes an eruption follows its use. Small doses of atropine paralyse the termination of splanchnic nerves, and as a result peristalsis is increased. Larger doses, however, stop peristalsis, as they paralyze the smooth muscular fibres of the intestine. Atropine paralyzes the inhibitory apparatus, and as a result of this there is an increase of the pulse rate and a rise in the blood pressure. There is also a rise in body temperature, due both to the increased force of the heart and paralysis of the sweat glands.

That atropine paralyzes the inhibitory apparatus was demonstrated by an experiment where the vagus was exposed and stimulated both before and after an injection of atropine; before the injection the heart was brought to a standstill as a result of the stimulation, but after the injection there was only a slowing of the heart.

All the members of this group, when injected into the eye cause a dilation of the pupil and are called MYDRIATICS in some books. Atropine and homatropine possess this action to a more marked degree than the others. Homatropine produces its effect much more rapidly than atropine. Its action however is not so prolonged and passes off sooner and for this reason is preferred by oculists. Dilation of the pupil by atropine lasts from one day to a week and on this account homatropine is used when it is wanted only for a short time. Not only is the pupil dilated but the whole apparatus of accommodation and adaptation is affected as a result of the paralysis of the end plates of the motor oculi nerves.

This is a local action only and is proved by the fact that the other eye does not dilate, or if given by the mouth there is never the same dilation seen as when applied locally. Atropine and homatropine first excite the central nervous system and then depress it.

Hyoscyamine from the beginning has a depressant effect resembling more closely a hypnotic and is used to some extent in quieting the central nervous system, especially the delirium of drunkards.

The action of atropine and the other substances belonging to this group upon the central nervous system is not made use of, except in stimulating the respiratory and cardiac centres with the exception of hyoscyamine above mentioned. Atropine in medicinal doses may cause excitation and delirium and in such cases give a subcutaneous injection of morphine.

The uses of atropine are as follows:--1. To dilate the pupil.

Rx Atropinae Sulphatis 0.25
Aquaee Distillatae 25.0

^m
Sig. One drop in each eye 2 hrs before
coming to oculist.

Antidote for atropine poisoning is morphine

~~Atropine sulphas .0005 - .001~~

2. To break up or prevent anterior adhesions. 3. To decrease salivation, perspiration, lachrymation, lactation, and bronchial secretions. 4. Antidote for poisoning by muscarine, morphine, and other drugs which depress the heart and respiration. 5. For constipation. 6. Stimulate heart and respiration. 7. To relax smooth muscular fibres, as when there is faecal obstruction or during the passage of renal calculi through the ureters. 8. Externally, in the form of plasters or ointment, to depress the terminations of the sensory nerves.

Depressant action is also made use of in excessive sweating of phthisis or obesity. When there is a low blood pressure and decreased pulse rate, caused by intercranial pressure, atropine is sometimes used, and as a result of its paralyzing action upon the vagi, the pulse rate and pressure is markedly increased. It is also used in bronchitis when the sputa is excessive.

Preparations of atropine are

TINCTURA BELLADONNAE FOLIORUM. *from leaves* 0.3.000 ~~2.000~~ ^{1.000}

From this tincture are made

EMPLASTRUM BELLADONNAE. *from dried resin and plaster of belladonna.*

UNGUENTUM BELLADONNAE. " "

EXTRACTUM BELLADONNAE RADICIS FLUIDUM. 0.060-0.200.

From the extract is made

LINIMENTUM BELLADONNAE. *from roots.*

When injected subcutaneously, the pure alkaloid is used in the form of ATROPINAE SULPHAS, which is a white substance readily soluble in water. Dose, 0.0005-~~0.003~~ ^{0.01}

HOMATROPINAE HYDROBROMIDUM. Dose, 0.0005-0.003. *1-80 Sol.*

EXTRACTUM STRAMONII SEMINIS. Dose, 0.010-0.030.

EXTRACTUM STRAMONII FLUIDUM. Dose, 0.060-0.200.

EXTRACTUM HYOSCYAMI FLUIDUM. Dose, 0.300-1.000.

TINCTURA HYOSCYAMI. Dose, ~~4.000-15.000~~ ^{1. - 4. cc.}

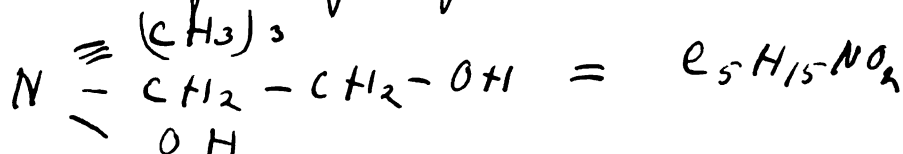
HYOSCYAMINAE SULPHAS white crystals, readily soluble in water
Dose ~~0.0005-0.003~~ ^{Max. .001 .0015 was fatal}

Poisonous doses and even in medicinal doses the actions of atropine may be summed up as follows: the skin is dry and hot and there may be an erythematous or scarlatinal eruption, dryness and pain in the throat and difficulty of swallowing due to the decrease in saliva, the pupils are dilated but not so markedly as when locally applied, there is a full bounding pulse accompanied by rapid respiration and the patient becomes mildly or violently

Antidote for muscarine = atropine.

crystalline. Sol in aq & practically
in all.

Choline = Hydroxyethyltrimethyl ammonium



Muscarine $\text{C}_5\text{H}_{15}\text{NO}_3$

Not used in medicine but cause
poisoning

Theophylline

delirious continually talking, shouting or laughing. Later the respirations becomes slow and shallow and the patient sinks into a comatose condition and dies from respiratory or cardiac exhaustion.

~~Agaricus muscarius~~
MUSCARINE GROUP. Belonging to this group are the alkaloids Muscarine or Choline derived from Agaricus Muscarius or fly mushrooms. Their chemical formulae resemble one another very closely; in fact muscarine is oxidized choline. Both have been synthetically prepared from ammonium bases. In the form of fly mushroom muscarine causes the death of a large number of people every year.

Its action is very complicated, almost opposite that of atropine. All those peripheral organs paralyzed by atropine are stimulated by muscarine. Its action upon the glands causes an increase of lachrymation, salivation and perspiration. The pupils becomes contracted; this is termed myosis. It acts upon the stomach, intestines and other organs with unstripped muscular fibres causing powerful contractions and as a result of this action upon ^{trinity} stomach and intestines there is vomiting and increased peristalsis. The stools at first may be hard fecal matter, but later watery and sometimes bloody. There is also increased micturition on account of its action on the bladder. *Heart = decrease in pulse rate even to a stand still.*

Upon the central nervous system its action is very marked, especially upon the respiration which is at first increased, then shortly followed by dyspnoea, the inspiration becoming slow, while the expirations are quick and short. The blood pressure falls, due partially to the decrease in the pulse rate as a result of the stimulation of the vagi and to the dilation of the blood vessels. Death occurs as a result of stoppage of the heart and respiration. Atropine is not entirely an antidote for muscarine poisoning, as muscarine entirely paralyzes the nerve terminations of the voluntary respiratory muscles; therefore, in cases of poisoning, artificial respiration must be resorted to as atropine does not affect the nerve terminations.

Xanthin.
CAFFEIN GROUP. The members of this group are DIMETHYLXANTHIN, or theobromine, is the alkaloid derived from the cocoa seeds. $1\frac{1}{4}\%$. $1\frac{1}{2}\%$
TRIMETHYLXANTHIN, or caffeine, derived from the coffee bean and tea leaves--long white crystals--without odor and a bitter taste, soluble in eighty parts of water.

GUARANINE. Prepared by the Brazilian Indians from a native plant and contains about five per cent. of caffeine.

COLANINE, or kolanine, is a compound of tannic acid with xanthine derivatives.

Caffeine in moderate and continued doses profoundly disturbs the digestive functions. Upon the central nervous system it causes great increase in reflex irritability, which may lead to tetanic convulsions. In this respect it resembles strychnine. It not only stimulates the muscle so that it contracts quicker, but it also performs a greater amount of work. It has been demonstrated on isolated muscle and isolated frog's heart that the total absolute amount of work when under the influence of caffeine is greater than normal, but if too large a quantity is injected the contraction may become permanent resembling rigor mortis. The cause of this contraction is not known. If this experiment is performed upon the leg of a live frog, the muscles become hard and bloodless as a result of the anaemia caused by the pressure of the muscles upon the blood vessels. When examined under the microscope the striae of the muscular fibres are also found altered in construction.

Medicinal doses of caffeine strengthen and quicken the heart action and at the same time the blood pressure is increased. This change in the circulation is not due to a decreased inhibitory action of the vagi as it is seen when they are cut, but it is probably the result of the direct local action of caffeine. In large or excessive doses the heart's action becomes irregular and this may sometimes be seen after moderate ones. Respiration is increased as a result of the general stimulation of the central nervous system. It is thought by some authors that the members of this group, when injected subcutaneously, cause local anaesthesia.

Beside the characteristic action upon the central nervous system, theobromine and caffeine stimulate the kidneys, causing an increased flow of urine. This is not the result of the increased circulation, but of the direct stimulation of the kidney epithelium. Until a short time ago it was thought that the increase was due to the action of caffeine and theobromine upon the straight and convoluted tubules, but recent experiments seem to prove that it is mainly due to its action upon the glomeruli. Of late years caffeine has been used to but a slight extent as a diuretic, theobromine being used in its place because it has less effect upon the central nervous system.

Neither Caffeine or Theobromine are very soluble in water, and for practical purposes some of their compounds are used, the double salts being more stable and readily soluble in water, and are used in preference to the other compounds.

Threonine seldom used as food
in water

Arginine - threonine + sodii acetate

Theophylline or Theosine, .2 - .4

Pituitine
Nigelline

CAFFEINA, white silky crystals without odor and of a bitter taste, soluble in 80 parts of water. , 45 - .3

CAFFEINA CITRATA is a white powder but not of a definite chemical compound. The following compounds are the ones most generally employed, Dose 0.100-0.500.

CAFFEINAE SODII SALICYLAS. } Easily soluble. Subcutaneous injection.
CAFFEINAE SODII BENZOAS. } .5 - .1 gms.

THEOBROMINAE SODII SALICYLAS or Diuretin. Dose up to 1.000 and not more than 5.000 in twenty-four hours. These double compounds contain from 30-50% of the free alkaloid. The use of these drugs in practical medicine is for stimulating the heart and central nervous system, but their action is not a prolonged one and may cause an irregular pulse which is seen in some after a cup of coffee. As a cardiac stimulant caffeine cannot replace digitalis on account of its short duration and varying action. It should never be used where the heart's action is ordinarily irregular as it will simply intensify this.

Of late years the double compounds especially of theobromine have been used as diuretics with very favorable results. Their action is not always sure, as in some cases no diuresis is produced. If five single gram doses per day are given for five or six days and no diuretic effect is seen, no more should be given, for if this amount does not produce the desired result neither will a larger quantity. The use of coffee and tea as beverages is simply because of their stimulating effect upon the nervous system. The action is about the same whether tea or coffee is taken, as a cup of coffee contains about as much of the active principle as a cup of tea, although much less tea is used.

PILOCARPINE GROUP. To this group belong the alkaloids pilocarpine and nicotine.

NICOTINE is a liquid prepared from the leaves of the tobacco plant, colorless when fresh, but turning brown with age; forms stable salts with tartaric acid. It has been practically abandoned as a medicinal agent. Tobacco leaves contain from 1-2 to 5% of nicotine. Pure nicotine is soluble in water, alcohol and ether. It has a very strong alkaline reaction, and on this account, when locally applied, acts as a caustic. *Jabrandi*

PILOCARPINE is extracted from the Brazilian shrub, *pilocarpus pennatifolius*. The free base pilocarpine is an oily substance forming crystallizable salts with acid. It contains oxygen differing from nicotine in this respect. Pilocarpine decomposes

into another alkaloid, jaborine, which has an entirely different action from that of pilocarpine. On account of this instability, one of the salts is used in place of the alkaloid itself. The hydrochlorate of pilocarpine is generally used. It is very soluble in water, quite soluble in alcohol, but practically insoluble in ether and chloroform. In damp air it becomes deliquescent.

Nicotine and pilocarpine stimulate all the peripheral organs which are stimulated by muscarine and paralyzed by atropine. As a result of the increased glandular activity there is profuse salivation, lachrymation, perspiration, and bronchial secretion, and there may be vomiting, defecation and increased urination as a sequel of its effect upon the muscular fibres of the intestines ^{stomach} and bladder. The pupils become contracted and later dilate to a certain extent but not lasting very long. The primary stimulating effect upon the inhibitory apparatus of the heart is very soon followed by its depressant effect, that organ becoming weaker and weaker:

NICOTINE acts very quickly and powerfully on the central nervous system, even in very minute quantities, all the centres becoming paralyzed especially the centre of respiration. Death is usually preceded by convulsions. The Chronic symptoms of poisoning are usually noted in people who use too much tobacco and differ materially from the Acute form. In these cases its most marked effect is upon the heart resulting in what is known as "smoker's heart" causing impairment and irregularity of its action. The eyesight may be also affected, paralysis of the optic nerve resulting sometimes from the excessive smoking which may disappear if smoking is given up. In Acute poisoning great excitement is first seen which is soon followed by its depressant effect with a sense of weight in the extremities. There is also nausea, vomiting and diarrhoea, often bloody, which may continue for several days.

✓ Pilocarpine may cause exactly the same symptoms except that much larger doses must be used. In comparatively small doses pilocarpine increases the sweat and saliva markedly. Both are excreted in the urine unchanged. All the effect of nicotine and pilocarpine may be overcome by atropine if given soon enough and in sufficiently large doses.

Nicotine is not used in therapeutics. Pilocarpine is mainly used to produce sweating; salivation and bronchial secretions are also all very much increased by its use. It has also been used in dry catarrh of the middle ear where the deafness was supposed to be due to a lack of secretion. It is best given subcutaneously, as if given by the mouth it is very liable to be vomited on

Some preparations also contain its antidote
labrine therefore use →

Effect not overcome by atropine.

account of its action on the stomach. It should be always used in the form of chemically pure salt only. Fluid extracts ought not to be used, as they frequently contain the alkaloid jaborine, which acts like atropine and may prevent the desired action. Most frequently used in the form of

PILOCARPINAE HYDROCHLORAS. Dose, 0.010-0.020.

Locally it is used in the form of an ointment to stimulate the growth of hair. It is a very valuable drug to produce diaphoresis and as much as three pounds of sweat and saliva being lost after a full dose.

CAUTION. As it increases not only sweat and saliva, but also the bronchial secretion, it should be used with great care in those cases where the secretion is already pathologically increased. In anaemia, and persons with weak hearts where the circulation is already poor, it should not be used on account of its depressant effect.

PHYSOSTIGMINE, the mother substance, is the calabar, or ordeal bean, the seeds of a West African plant. These seeds contain three different alkaloids: 1. Physostigmine, or eserine. 2. Eseridine, which has the same action as physostigmine but much weaker. 3. Calabarine, a member of the strychnine group, and identical in action with strychnine.

The action of physostigmine is quite a curious one. It stimulates all the different muscular organs, striped or unstriped, and the protoplasm of all the secretory glands. As a result of this, the secretion of the glands is much increased and there may be vomiting, diarrhoea, increased micturition, etc., from its action upon the stomach, intestine, and bladder. It also causes more powerful contraction of the heart and there is a rise in blood pressure which is due only to the increased muscular power of the heart, as the vaso motor centres are paralyzed. The pupil may be contracted by the use of physostigmine after atropine has been applied. This cannot be done by the use of either muscarine or pilocarpine, as both of these effect only the terminal nerves which are paralyzed by the action of atropine and will not respond, while physostigmine acts directly on the muscle fibres and so can produce contraction.

Physostigmine might be used as an antidote for many poisons but for its action upon the central nervous system. Unfortunately it paralyzes all centres of the central nervous system and acts very powerfully in small doses. Its effect upon the centre of respiration is especially marked, and in poisonous doses the heart will be

~~Sentence~~ crossed out = O.K.

found beating quite strongly after respiration has entirely ceased. Its depressant effect is very marked in human beings.

Its stimulating effect on the muscles is due to its direct action upon the muscular fibres and not to stimulation of the nerves, as this may be produced after the animal has been poisoned with muscarine. If the intestines of an animal are examined after poisoning with physostigmine it is found to be pale and colorless due to the anaemia caused by the contraction of the muscular fibres of the intestine which press upon the blood vessels and prevent the entrance of blood.

It is mainly used by ophthalmologists to contract the pupils. ~~It is also used in posterior adhesions of the eye; that is, where they are between the iris and the lens.~~ ^{Myriasis} In anterior adhesions atropine is used. Because of its action in reducing intraocular pressure it is used in glaucoma and ulcerative processes of the cornea. In cases of constipation as a result of the inability of the intestines to contract it may be sometimes used with good results. In cases of this sort a dose of 0.0002-0.0003 should be given and not repeated for some time as its action lasts for two or three days. The U. S. P. contains an extract and a tincture, but their use is not rational as the crude drug contains the alkaloid calabarine which acts identically with strychnine. Only chemically pure physostigmine should be used in the form of

PHYSOSTIGMATIS SALICYLAS, colorless, or slightly yellow crystals, soluble in one hundred and twenty parts of water, or

PHYSOSTIGMATIS SULPHAS, very deliquescent. Maximum doses of either is from 0.0005-0.001, and not more than 0.003 in twenty-four hours.

COCAINE is derived from erythroxyloin coca leaves, a South American plant cultivated in Peru, Bolivia and northern part of Brazil. In these countries coca leaves are quite extensively used. Cocaine consists of white crystals soluble in water and alcohol, decomposing when boiled with water. It forms crystallizable salts with mineral acids.

When locally applied it paralyzes the peripheral sensory nerves at the place of application. It is the only vegetable drug which acts on the nerve trunks and paralyzes the sensory and motor nerves. The insensibility to pain lasts from twenty to thirty minutes.

Applied a 10% solution of cocaine to a rabbit's eye, but first stimulated with a weak current to show the reaction. In five or ten minutes the eye became insensible to the same current,

and even if the current is slightly increased. The insensibility lasts from ten to thirty minutes, and at the same time the pupils will dilate. This dilation lasts a day or longer. Only the cornea and not the eyelid is anesthetized as the action is purely local. It does not show any anesthetizing effect if given internally except where it comes in contact with the mucous membranes, differing from morphine in this respect, which acts through the central nervous system. Cocaine acts the same as physostigmine in reducing intraocular pressure but less powerfully.

Constitutional effects after absorption are mainly on the central nervous system, first exciting and later depressing all the centres. It has no effect on the sensory nerves. In poisonous doses respiration and pulse are increased. Symptoms of poisoning are giddiness, headache, pallor of the face, sensation of cold in the extremities and dryness of the throat. Later nausea, vomiting and general weakness may be very marked and also a rise of temperature. In some cases the secretion of urine is increased and in others it is decreased, and lastly loss of consciousness, convulsions and dyspnoea supervening. Death results from the cessation of respiration with signs of collapse. One-fourth of a gram is a lethal dose. Cases of poisoning have occurred when applied locally to urethra and vagina.

Symptoms of chronic poisoning differ materially. They appear first in the digestive tract; there is loss of appetite, flesh and anaemia and all the symptoms of chronic malnutrition.

The central nervous system becomes very much impaired as well as the circulatory system and a good sensible man may become a beastly character. The preparations are

EXTRACTUM COCAINAE FLUIDUM, but for practical purposes the COCAINAE HYDROCHLORAS ought to be used. Dose Internally and Subcutaneously 0.008-0.050. Not more than 0.150 in twenty-four hours. *0.25 = lethal dose in human beings.*

Lately some substances have been put on the market as substitutes. The most important of these is EUCAINE and some of its compounds. These are good substitutes in some cases, but as yet there is none which have come into general use. There is not a single alkaloid in the vegetable kingdom, which, on the whole, is a good substitute for cocaine.

As a local anesthetic cocaine is generally applied in a watery solution of the hydrochlorate. It may be applied to mucous membranes or to the eye directly as by dropping, or in the form of a spray. Applied locally to the skin, it will not

produce anesthesia, but must be injected into the subcutaneous tissues by means of the hypodermic needle. It may also be used in the form of very dilute watery solution to relieve pain in the stomach from excessive vomiting, or applied to mucous membranes of the throat, nose or ear, to render examination less painful. It may also be given with irritating drugs, such as chloral hydrate, to counteract their effect upon the mucous membranes of the stomach, and thus prevent vomiting. A very small amount of cocaine when given with one of these drugs, or shortly before its administration, will quiet the stomach for half an hour or so, giving an opportunity for absorption to take place.

CAUTION. In applying cocaine to patients who have never had it used before a very dilute solution only should be used at first until their resistance to it is determined, as untoward results are produced in some people by the use of small amounts of the drug. Under no circumstances should it be used for a very long time lest the habit be acquired by the patient.

The infiltration or Schleich method of producing local anesthesia consists of injections into the lower layers of the skin of a solution containing cocaine hydrochlorate, morphine, common salt and distilled water. As originally suggested by Doctor Schleich, there were three solutions, a strong, medium and weak, varying in the amount of the alkaloid which they contained. The stronger solution was used where the skin was especially sensitive, as in inflamed areas, and the weaker in those areas where sensation was not so marked. The more important and most useful solution contains:

Cocainae Hydrochloratus	0.060
Morphinae Hydrochloratus	0.030
Sodii Chloridi	0.120
Aquae Destil.	60.000

This solution is injected into the lower layers of the skin where it forms a rounded swelling resembling a wheal about one-half inch in diameter. The next injection is made into the edge of this swelling and so on until the desired area is entirely injected. The efficiency of this method does not seem to depend so much upon the alkaloid as upon the amount of solution injected. If a sufficient quantity of cold water is injected in the same manner anesthesia will also be produced. Under this method of Schleich, some major operations have been performed, but it is hardly desirable for this class of operations as even with complete local anesthesia the patient may be so affected, knowing

Leontine not known.
Seldom used practically.

Socrates praised by this.

that an operation was being performed, that complete anesthesia is preferable unless contraindicated for some reason.

CURARAE or the South American arrow poison is a dark brown or almost black resinous substance, of a bitter taste. It contains Curarine and other substances of less importance. This alkaloid is a yellowish white powder which is soluble in water. It does not form crystallizable salts with mineral acids.

Its main action consists in paralyzing the nerve endings of the motor nerves in the skeletal muscles, unstriated muscles become paralyzed much later. In warm blooded animals it is absorbed slowly from the intestines and excreted so rapidly by the kidney that large doses may be taken internally without harm. Injected subcutaneously it is one of the most poisonous drugs known. 0.0003 per kilo of body weight when injected into dogs, cats or rabbits has proved to be a lethal dose. Its action upon warm and cold blooded animals is the same causing paralysis of the motor nerve endings, and death is due to the stoppage of respiration. Artificial respiration, if resorted to, may enable the animal to live until the curarine is excreted. The heart, after the stoppage of respiration, is found to be beating strongly as the drug, except in large doses, does not effect the circulatory system. Its action is upon the nerve endings and not upon the central nervous system. If strychnine is injected into a curarized frog, it will not produce convulsions because the nerve endings and neither the central nervous system nor muscles are paralyzed. It is sometimes used in cases of tetanus hydrophobia and epilepsy to relieve muscular spasm and in some instances acts very well.

CURARINUM PURISSUM. Dose 0.001-0.003. Before using it on human beings the drug should be tried on animals or frogs in order to determine its strength. As the crude preparations vary much in strength, they should never be used without this precaution being taken. After curarae is injected the doctor should not leave the patient as cessation of respiration may occur and by immediate artificial respiration the patient's life may be prolonged for sufficient time to allow the drug to be excreted and an undesirable accident averted.

CONIINE GROUP. In this group belong the alkaloids, Coniine, Lobeline, Gelsemine and Sparteine.

CONIINE isolated from the coniine maculatum, or spotted hemlock, growing in Europe and Asia, and of late years in the United States. It has no practical interest except as a member of this group. It is a colorless, oily liquid, of a disagreeable odor, and
Mistaken for parsley.

Nepaline.

is readily decomposed by light and heat--does not contain oxygen. Its salts are more stable and are used in the form of hydrochlorate and hydrobromate. Their action is identical with the free base. As it is volatile, the use of tinctures and plasters is not rational.

LOBELINE. Extracted from the lobelia inflata, or Indian tobacco, growing only in the United States. The pure alkaloid is an amorphous substance, and has no crystalline salts. Preparations are

EXTRACTUM LOBELIAE FLUIDUM. Dose 0.060-0.600. *Not given*

TINCTURA LOBELIAE. Dose 0.300-2.000, not more than 5.000 in twenty-four hours.

GELSIMINE^{ine}. Extracted from yellow jelsimin^{ine} which contains two alkaloids, 1st, Gelsimine, and 2d, Gelseminine. The first is a member of the strychnine group, and Gelsimin^{ine} belongs to this group. It is an amorphous substance, easily decomposed, and has not been obtained in the crystalline form. U. S. P. contains

EXTRACTUM GELS^MIMINE FLUIDUM. Dose 0.300-0.600. *Not given*

TINCTURA GELSIMINE. Dose 1.000-4.000.

SPARTEIN. Contained in spartium scoparium, or common broom plant. Is a native of Southern Europe, but now naturalized here. The free alkaloid is a liquid, and does not contain oxygen.

SPARTEINAE SULPHAS. White colorless crystals, very soluble in water and alcohol. Dose 0.008-0.015.

Besides the alkaloid spartein, the broom plant also contains the alkaloid Scoparine, an amorphous substance of a pale yellow color.

EXTRACTUM SCOPARII FLUIDUM. Dose 1.000-4.000.

The action of this group is not well understood. The following however is known. They all paralyze the motor nerve endings in skeletal muscles of cold blooded animals, but to obtain this effect large doses must be used. In warm blooded animals and man this action is only incomplete and death occurs from a paralysis of the central nervous system before the paralyzing effect is very marked. They depress the central nervous system and act as narcotics. If large enough quantities are used there may be complete paralysis.

Gelsiminene, Coniine and Sparteine depress the respiratory centre from the beginning. Lobeline first stimulates and at the same time paralyzes the terminations of the vagi in the lungs as a result of this the respirations are increased and more air enters

into the lungs thus making it of great value in asthma. Later with larger doses the respiratory centre becomes depressed exactly the same as with the other members of this group. Their action upon the heart is only well studied in cold blooded animals. Lobeline in the frog stimulates the vagi causing a decrease in the pulse rate and if larger doses are given the vagi are paralyzed and the action is the same as that of atropine, but at last the heart itself becomes paralyzed. Gelseminine acts analogous to Lobeline in this respect.

Sparteine stimulates the heart but this action is questioned by some. The whole central nervous system will become depressed by all four substances and death as a rule is due to the cessation of respiration. Sometimes convulsions precede death. The circulation is also depressed. They all dilate the pupils acting in this respect like atropine. Their action upon the salivary glands, stomach and intestines is a stimulating one. They were formerly used to execute prisoners and the most notable instance of this was Socrates and one of the most graphic reports of the action of coniine poisoning is found in the records of this famous case.

Poisonous symptoms may rarely be seen in accidental cases. The first symptom noticed is that the limbs become tired and numbness of the extremities followed by paralysis, which passes from below upward, the muscles becoming affected later. Treatment in these cases is to empty the stomach, artificial respiration and stimulants.

Coniine is not used much, but formerly it was used to depress the central nervous system. When used it should be in the form of bromhydrate and not the crude preparation.

Gelseminine has been used to dilate the eye and also in diseases of a convulsive nature.

Lobeline is used in asthma, especially where contraction of the alveoli and also in bronchitis.

Sparteine is used in cases of irregular heart and cardiac diseases, and in the hands of some it has given good results, while others report no action. *Dr. J. S.* 0/5

ACONITE GROUP. Contains the alkaloids extracted from the different species of aconitum napellus, growing mostly in the mountainous regions of Europe and Asia. Aconitine, Napelline, Tapaconitine. These are found in both amorphous and crystalline forms. To this list may be added the alkaloid

DELHPININE, extracted from a plant growing on the shore of the

Mediterranean. In former years the amorphous forms were considered much weaker than the crystalline, but the strength is the same in either case. The reason for this erroneous idea was that the amorphous form is very readily decomposed. The action of these four alkaloids is identical in quantity and quality. In determining the action of the drug the alkaloid and not the crude drug should be used as the quantity of the active principle may vary greatly in the different drugs.

The experiment with the chemically pure substance shows that peripheral organs may be first stimulated and then paralyzed. The paralysis affects the sensory, circulatory and motor nerves producing tingling, numbness and lastly a local anesthesia. This local anesthesia may be quite marked and last for quite a while. The effect upon the heart is very marked, first stimulating the motor ganglia with a correspondingly increased action, later the stimulation subsides and paralysis of the motor ganglia ensues. The vagi are powerfully stimulated and as a result the pulse becomes slower and still later its force and tension decrease with a corresponding fall in blood pressure. The effect upon the respiration is the same, first hurried and later very slow, death resulting from its cessation. The U. S. P. contains

EXTRACTUM ACONITI. Dose 0.015-0.045.

EXTRACTUM ACONITI FLUIDUM. 0.050-0.100.

TINCTURA ACONITI. 0.030-0.300.

ACONITINA. The pure alkaloids, 0.00006-0.00025. From this last an ointment is made, OLEATUM ACONITINAE. There is an ointment made from Delphinine but this is not official.

Its local anesthetic effect is made use of in facial neuralgia. Used internally to decrease the frequency and force of the heart beat. Formerly it was much used as an antipyretic but its use in this direction has been much abandoned in late years. An erythematous eruption is often noticed as the result of the administration of aconite. In toxic doses there is some muscular weakness, particularly noticeable in the lower extremities, accompanied by tingling and numbness of the hands, feet and sometimes over the entire cutaneous surface. The pulse at first slow, becomes rapid and almost imperceptible and the respirations are shallow and feeble. The skin is pallid and covered with a cold sweat. In the treatment of poisoning the patient should be placed in a horizontal position with the feet slightly raised. The temperature should be maintained by external heat and diffusible stimulants administered. Atropine and Strychnine may be given to stimulate the heart and

Vomiting, increased ^{lymphatic} secretion, expectoration

Dose .005 - .015

children .001 - .003

Never use subcutaneously.

Radix Ipe. up 2.0 vomiting
up 5.06 expector

child .001 - .003

respiration. The stomach should be washed out but emetics should not be used as they may interfere with the cardiac action.

Formerly the action of aconite was made use of to reduce the force and tension of the pulse by its depressing action on the heart, especially in febrile diseases, but since the teaching of today is not to reduce the blood pressure in these cases there is now no indication for its use internally. It is a very dangerous drug and since there are many others much less toxic in their action which produce as good therapeutic results it is best not to employ aconite at all, except perhaps, externally as a local anesthetic.

EMETINE GROUP. To this group belong Apomorphine, Ipecacuanha or Ipecac and Quebrachobark.

APOMORPHINE is artificially prepared by heating morphine with concentrated mineral acid. It is a hydrochlorate of morphine, and consists of grayish white crystals having a faintly bitter taste, turning green when exposed to air or light. Soluble in fifty parts of water and same quantity of alcohol. The freshly prepared solution turns green without much loss of strength.

IPECACUANHA is the root of *cephaelis ipecacuanah*. The active principle is the alkaloid emetine. When freshly prepared it is a white, bitter substance, slightly soluble in water, very soluble in alcohol, ether and chloroform. The chemically pure substance is not used as it is not stable, turning black and losing its strength on exposure. In practical medicine either the powdered root or one of the following official preparations are used.

PULVIS IPECACUANHAE. Dose 1.00-4.000.

SYRUPUS IPECACUANAAE. Dose 0.300-8.000.

VINUM IPECACUANHAE. Dose 0.060-4.000.

QUEBRACHO is derived from *aspediosperma*. The bark contains not less than five alkaloids. In practice only the crude preparation of quebracho in the form of decoction and extracts are used.

EXTRACTUM ASPIDOSPERMATIS FLUIDUM. Dose 0.300-2.000. ~~2.000-4.000~~

Substances of this group taken internally produce the sensation in warm blooded animals and in man called nausea, general malaise, muscular relaxation, and sensation of heat. Salivation is increased and likewise the bronchial secretion. If sufficiently large doses of these drugs are administered, nausea is followed by vomiting. Apomorphine is the most powerful drug in this respect. Vomiting is produced rapidly, not only if given internally, but also if subcutaneously. All animals that can vomit are influenced this way by apomorphine. Vomiting is caused by direct stimulation of the centre of vomiting. In man, vomiting occurs in ten or fifteen minutes after the injection of 0.005 to 0.015 of apomorphine subcutaneously. If vomiting does not occur in fifteen minutes,

10 min.

the dose must be repeated. Results are obtained quicker subcutaneously than by mouth.

Ipecac when used as an emetic is always given internally, as it is not suitable for subcutaneous use on account of its local irritating effect, producing first redness, vesication and if quantity applied locally was large enough there may be pustulation. To produce vomiting either the Wine, Root or the Syrup may be used. The root will take longer to act because the active principle must first be extracted and then absorbed into the circulation. In man, when given in large doses, vomiting may occur in a half hour or longer and sometimes only after days. Absorption of the active principle is slow and that is one of the reasons vomiting occurs so late. It is this slow absorption that makes this drug useful when we want to increase bronchial secretion. Apomorphine would not act well for use as an expectorant because of its rapid action.

QUEBRACHO. The alkaloid aspidrosperma acts identically to apomorphine. The characteristic effect on the bronchial secretion makes this drug of value.

THE USES. Quebracho-bark preparations are useful in such cases where respirations are pathologically increased.

The local irritant action of Ipecac, redness, vesication, and pustulation, is also seen in the intestine besides the vomiting effect. More toxic symptoms are produced in animals than man. In man a large dose would be vomited. In lower animals ipecac, after being absorbed, is excreted into the lungs and may produce severe congestion of the lungs due to the local irritation produced.

Stimulation, after the use of apomorphine is seen on other parts of the central nervous system. Excitement is especially well marked in warm blooded animals. To demonstrate it, will inject a small quantity of apomorphine into a rabbit. You will notice first the respirations are increased, and later on the excitement of the central nervous system will show itself in the following symptoms: The animal will become very much frightened (rabbit can not vomit), increase of respiration, quite nervous, will run around. After primary excitement,--which is not seen in human beings, as not enough is given,--it will depress central nervous system, especially the respiratory centre, and cessation of respiration is the cause of death.

If you wish to empty stomach quickly, use apomorphine. With emetine or crude preparations of ipecac, the time required is from one to two hours, so we never use emetine, but always apomor-

phine subcutaneously. For expectorants use quebracho and ipecac, whose action, because of this slow absorption, will be continued for a long time.

One caution must be mentioned. Vomiting may produce a depressant effect on children and febrile persons. In such cases it would be best to use the stomach pump.

SAPONINE GROUP. The action of these drugs is very similar to those of the emetine group. Locally as irritant. Internally to increased bronchial secretion. The active principles which the different drugs contain are mostly glucosides and do not contain Nitrogen. They dissolve easily in water making the solution resemble soap water and so are called Saponines. Other members of this group are very poisonous and are called Sapotoxines. They are easily decomposed by chemical agents and transformed into inert substances.

SENEGA or Polygala Senega or Senega Snake Root is grown in the United States. The active principles are Senegine and Polygalicanic Acid both of which are glucosides. Senega dissolved in water makes a soapy solution.

EXTRACTUM SENEGAE FLUIDUM. Dose 0.600-2.000.

SYRUPUS SENEGAE. Dose 4.000-8.000.

SAPONARIA RUBSA or Soap Root. The active principle is Saponine.

QUILLAJA or Soap Bark contains two very toxic substances, Sapotoxine and Quillaic acid, both glucosides easily acted upon by chemical reagents and transformed into inert substances.

TINCTURA QUILLAJAE. Dose 2.000-~~4.000~~ 8.000

SARSAPARILLA obtained from the different species of Smilax of which there are eight or ten. The active principle is the glucoside Parilline.

EXTRACTUM SARSAPARILLAE FLUIDUM. Dose 2000-4000.

EXTRACTUM SARSAPARILLAE FLUIDUM COMPOSITUM. Dose 2.000-8.000.

Locally they act as irritants, are irritating to mucous membranes of eye, nose, mouth and stomach and as a consequence will increase lachrymation and salivation. Sneezing and coughing are common occurrences. This local disturbance may become a more or less constitutional disturbance. The bronchial secretion is increased which is due to the local irritant effect because the drug is excreted into the bronchi. In case large doses are taken then the local irritation will produce vomiting and diarrhoea not giving time for absorption, even Sapotoxine will produce no toxic symp-

toms. This is due to the fact that Sapotoxine is not absorbed from the healthy mucous membrane of the intestine but if given intravenously or subcutaneously the poisonous effect will be seen at once as is also the case where the mucous membrane is ulcerated. When Sapotoxine is injected into a vein of a rabbit death is caused by the cessation of respiration.

TINCTURE OF SENEGA and Tincture of Quillaja are mainly used as expectorants. Quillaja has a more agreeable taste and preferred for that reason.

Sarsaparilla is never used alone but always in combination with other substances. It is especially used in the antisyphilitic treatment. There is a difference of opinion as to whether it does any good or not because it has only a local irritant effect on the intestine and may be useful only so far as it helps absorb more food. The antisyphilitic properties have never been demonstrated because it is combined with preparations which have so many ingredients that is impossible to tell how it acts. Compound Tincture of Sarsaparilla has of course antisyphilitic action, when it contains Potassium Iodide or Mercury. Secretion of urine may be increased, but antisyphilitic action has never been demonstrated.

Zittman's Decoction is a preparation of Sarsaparilla. Sixty or eighty years ago nearly all cases of syphilis were treated with it especially the ulcerative forms.

VERATRINE GROUP. To this group belong the different alkaloids extracted from different species of veratrine and the alkaloid extracted from *asagroeae officinalis* or *sabadill* seeds.

VERATRUM VERIDE, or Am. Hellebore, is a grayish powder, and on entering the nose produces sneezing. It has two alkaloids:

VERATROIDINE or Protoveratrine, better known under the last name, is a crystalline substance intensely poisonous.

JERVINE. This is less toxic. There has also been extracted three other substances which are not toxic: Rubijervine, Pseudo-veratrine, and Protoveratridine. Veratrine substances do not contain veratrine. It has been extracted from *sabadill* seeds only.

Action of the Veratrine group. The sensory nerves of skin, conjunctiva, tongue, mouth and stomach, become first stimulated by veratrine; that is when rubbed in in the form of ointment, and not so much by protoveratrine. Produce first a prickling sensation and a feeling of heat which may become more intense, and a sensation of burning and stinging pain without any signs of inflammation being present. The irritation of the sensory nerves

of the eye cause lachrymation and local irritation of nose, sneezing. In mouth and stomach similar sensations are felt, that is, prickling and burning heat; later irritation subsides and symptoms of paralysis are very marked. Skin is benumbed, sensation being diminished, as is also the sense of touch. Local anesthetic effect is quite marked, and is produced by veratrine and protoveratrine only. Protoveratrine does not cause the primary stimulation. Primary stimulation is also noticeable on the mouth, oesophagus and intestine, producing an increase of salivation, retching vomiting, and increase defecation. All these symptoms are not accompanied by any signs of inflammation. May be due to the effect it has on the nerves or the glands.

On a frog, subcutaneous, the extension of legs is quite normal, but frog does not bring his legs back promptly; does it slowly and quite incoordinately; the muscle loses its contractile power. This peculiar veratrine action, not only observed on the skeletal muscles, but also on the muscles of the heart. Protoveratrine hasn't this effect.

On the central nervous system after primary stimulation causing increased respiration, if simply one of paralysis and death is due to asphyxia. Convulsions as a rule precede death.

TINCTURA VERATRA VIRIDIS. Dose 0.120-0.600.

UNGUENTUM VERATRINAE.

Uses of these alkaloids. Stimulating effect of veratrine has been used in the preparation of snuff sprinkled over ulcers; in facial neuralgia, rheumatism and gout, by rubbing the ointment into the skin and producing local anesthesia. Veratrine and protoveratrine to reduce blood pressure in cases of febrile disease as pneumonia, bronchial pneumonia and acute rheumatism. The local effect on the intestines may produce severe vomiting and diarrhoea. Veratrine is very depressant on the central nervous system. After extensive trials in the medical school it has been given up on account of producing severe collapse. Circulation depressed, respiration depressed, temperature falls two or three degrees. The whole metabolism is depressed.

ERGOT GROUP. The drugs of this group are used mainly in practical medicine to act upon the uterus or to stop hemorrhages. The drugs of this group are Ergot, Hydrastis, Cotton Root Bark, Ustilago Maydis, or Cornsmut.

COTTON ROOT BARK is employed in the South by the negro women to produce abortion.

USTILAGO MAYDIS. A fungus growing in maize.

Golden Seal

HYDRASTIS. From the rhizome of *hydrastis canadensis* growing in the northern part of Europe. It contains two alkaloids, Berberine and Hydrastine. Hydrastine is transformed by oxidizing agents into HYDRASTININE HYDROCHLORATE, and has been used quite extensively during the last ten years. It consists of a pale yellow crystalline powder, bitter saline taste, deliquescent on exposure to damp air, very soluble in alcohol and water, but with difficulty in ether. Dose ~~0.010-0.050~~; ~~in twenty-four hours up to 0.100~~.⁸⁵ May be given in pill form or in 10% watery solution subcutaneously. The preparations of the crude drug are

EXTRACTUM HYDRASTIS FLUIDUM. Dose 0.300-~~1.000~~.¹⁵

TINCTURA HYDRASTIS. Dose 2.000-~~8.000~~.^{8.000}

GLYCERITUM HYDRASTIS. Dose 0.300-~~1.000~~.

Hydrastis and Hydrastinine. These drugs in medicinal doses increase only blood pressure which is probably due to the stimulating effect upon the vaso motor centre; and as a consequence the blood vessels contract and the blood pressure rises. In this respect they act analogous to ergot. In large doses they paralyze the central nervous system.

ERGOTA. From the spawn or mycelium of the fungus, known as *claviceps purpurea*, which grows in the flower and replaces the grain in the common rye or *secale cereale*. Its chemistry is not very well known, nor is the active principle. From it is extracted the syrupy alkaloid Cornutine and two amorphous substances: Sphacelotoxine, soluble in alkalies; Ergotoxine, soluble in dilute mineral acid. None have been obtained in a chemically pure state. Its preparations are

EXTRACTUM ERGOTAE FLUIDUM. Dose 2.000-~~4.000~~.⁵

EXTRACTUM ERGOTAE. Dose 0.300-~~1.000~~.

VINUM ERGOTAE. Dose ~~1.000-16.000~~.

Ergot exercises little or no effect on the central nervous system. It produces first a primary fall and then a considerable rise in the blood pressure, due to the contraction of the small blood vessels as a result first of the stimulation of the vaso motor centre and later the muscular fibres of the arteries. In very large doses the primary fall in blood pressure will not be recovered from. If given to keep the blood pressure high for any length of time the smaller arteries may become hyaline thrombosed and if its use be continued for weeks and sometimes only for days it will produce gangrene.

Artificial gangrene can be produced on roosters. If they are given ergot subcutaneously, the comb in two or three hours becomes perfectly black and later dries up and falls off. Occasionally the

joints become gangrenous and the wing can be disarticulated without loss of blood.

Formerly ergot poisoning was quite common in Russia, but of late years better food is used, and this is not so common.

Besides the rise in blood pressure, the two amorphous compounds contract the uterus, especially if pregnant, by their direct action of the muscular fibres. Cornutine always produces convulsions as well as a rise in blood pressure.

Hydrastis and Ergot are given to prevent or stop uterine hemorrhages. Hydrastis is not used at the time of parturition, but at the time of menstruation to stop excessive flowing. Empirically they are both used in inflammation of mucous membranes from the mouth to the rectum. How the good results are produced is not known.

Ergot is given mainly to parturient women to arrest hemorrhage, but should not be given, according to the teaching of this school, until after the placenta has been delivered. Bleeding stops as a result of the contracting uterus pressing upon the vessels, and the contraction of the vessels themselves. It has also been given in hemorrhage from kidneys and lungs, but a beneficial result is not always seen and sometimes the opposite occurs on account of the rise in the blood pressure. Its use in hemorrhage from these organs is not analogous to those from the uterus, as the bleeding of the uterus is controlled in a great measure by the muscular contraction of that organ, and this contraction is not present in either lungs or kidneys. Ergot has been used in the treatment of uterine tumors, especially of the submucous variety, and acts beneficially in some cases, probably because it interferes with their nutrition by its action upon the blood vessels and uterus. Its prolonged use, however, is dangerous, and undesirable results have often been seen in from three to four weeks after its use has been abandoned, and shows it is eliminated slowly. It should be given only in acute hemorrhages.

QUININE GROUP. Comprises the different alkaloids extracted from the various species of Cinchona Bark, of which there are twenty or more. It has been used by the Indians for antifebrile purposes. There have been artificially prepared substances by the dozens, but none can take the place of Quinine in malaria. The principal alkaloids of this group are

QUININE, CINCHONINE, CINCHONIDINE and QUINIDINE.

The action of these various alkaloids is exactly the same as

Quinine, differing only quantitatively. Before it was obtained in the form of the alkaloid, crude preparations were used, of which the U. S. P. contains

EXTRACTUM CINCHONAE.

EXTRACTUM CINCHONAE FLUIDUM.

TINCTURA CINCHONAE.

These should be used only as tonics; as antifibrile medicine one of the chemically pure alkaloids should be used. The most important of these are

QUININAE SULPHAS. White silky needle shaped crystals, containing 73.9% of water free quinine. Soluble in about 800 parts of water, in 65 parts of alcohol. Freely soluble in mineral acids. If about an equal quantity of dilute sulphuric acid is added to it it becomes readily soluble in water.

QUININAE BISULPHAS, colorless transparent crystals or needles containing only 59% of water free quinine. Soluble in ten parts of water and in about thirty parts of alcohol. It costs about 25% more than the sulphate.

QUININAE HYDROCHLORAS. White silky needle shaped crystals, soluble in 34 parts of water and in three parts of alcohol.

All the salts of quinine are white when freshly prepared but turn dark on exposure to light. Besides the above salts there are many others but have no special advantage. *This is the most practicable.*

Binz's theory was that quinine must act by specific action on the specific cause. He studied it on the infusoria, and if in a 1 to 2000 solution after two or three minutes they became an organic mass. On protoplasm of different origin the action will be different. The white corpuscles are easily affected in solution of one to two thousand, the leucocytes and lymphocytes cease their motion and in one or two hours they become darker and die. Quinine prevents the formation of pus and is sometimes called a protoplasmic poison. If quinine is injected the leucocytes lying near the vessel retard, and no more leucocytes or lymphocytes pass through the walls and the number also decrease in the current. The red blood corpuscles so far as known are not affected. White blood corpuscles are ^{easily} ~~lastly~~ affected, but nervous and muscular tissues are more resistant to its action. The circulation is depressed, later the central nervous system and lastly the respiratory centre, death occurring, as a rule, after a few convulsions. All the constitutional effects of quinine may be explained by its action on the different protoplasm.

The lowering of the body temperature may be due either to an

increase loss of heat or a decrease heat production. In the use of quinine it is due to a decrease of internal oxidation which is shown in the decreased amount of urea excreted, showing that there is a lessened metabolism. This marked antipyretic effect is most marked in febrile cases. In normal animals and man it does not lower temperature to any extent and may even raise it slightly.

Untoward Effects. By these we understand some effects which are not characteristic of the drug administered under ordinary circumstances; that is, in the administration of an antipyretic to fifty persons, forty-five of these will have a reduction of temperature and five will not, and this exception to the usual rule is known as untoward effects. They are quite common with quinine. Sometimes these symptoms may persist for quite a long time. Severe gastro intestinal disturbance may be the result of repeated small doses, and further administration is impossible. Quinine may be given by the mouth, rectum, or subcutaneously, and in the last few years it has been given intravenously. The difficulty of giving it by the mouth is because of its very bitter taste and insolubility. Small doses are better given in watery solution on account of its quicker absorption. If the solution is very concentrated, it acts as an irritant and may cause vomiting; sometimes it may be quite well to give it in combination with rum or some other alcoholic drink. It may be given by the rectum in the form of an enema with milk or cocaine.

Hydrochlorate is decidedly the best to give as the sulphate is quite insoluble and therefore not so readily absorbed. The objection of the bisulphate is its increased cost and small amount of active principle it contains.

Uses. 1. As a cure for malaria. 2. As a preventive for the same disease. 3. As an antipyretic in febrile condition. 4. As a stomatic. 5. As an antiseptic. 6. For miscellaneous uses. As a cure for malaria it should be given in 1.000 or 2.000 doses two or three hours before the chill is expected so as to be absorbed and circulating when the paroxysm comes on as at that time the organism is most easily destroyed. After the chill is over the use of quinine should be continued in small doses until the spleen has returned to its normal size, but it must be remembered that if the spleen has been enlarged six or eight times the normal size it will never become quite as small as originally. In cases of pernicious malaria it is given in large and repeated doses. As a prophylactic measure it should be given in large doses for two or three days

before reaching the malarial regions and then in small doses afterward. As a general antipyretic it is used now only in typhoid fever in 1.000-1.500 doses. If the circulation shows any depressant effect it is best given in combination with a heart stimulant. As an antiseptic it is used in cases of dysentery due to amoeba. It is also used in indolent ulcers in solutions of 1-500 or 1-1000. Miscellaneously used in migraine, neuralgia and whooping cough but it is doubtful whether any results are obtained in the latter. In inertia of the uterus it is used sometimes with good results. As a stomachic one of the crude preparations is used usually with excellent results. Quinine also enters into the composition of many hair tonics and is highly recommended by some physicians in the treatment of alopecia.

During the past twenty-five years a large number of drugs has been gotten up as substitutes for quinine. Their classification differs very much with different authors but we will study these groups according to the chemical properties as this seems to be the best classification. Many authors have attempted to classify them according to their actions, but this is hardly possible as they have not been thoroughly worked out in many cases. As a rule their action is to decrease the temperature and the protoplasmic action of the lower forms of tissue; therefore like quinine they are antipyretic and antiseptic. They may also act as analgesics.

Untoward effects. There may be skin eruptions, disturbances of digestion, cyanosis and collapse. Cyanosis and collapse are very often noted, cyanosis being due to the formation of Methemoglobin. Collapse may be caused by any of these drugs in moderate doses, and many accidents have occurred through their indiscreet use by the public. In using antipyretics we must mention under untoward effects, the irritation of the kidneys, inflammation sometimes resulting. All these drugs in large quantities depress the central nervous system, and death as a rule is due to the cessation of the respiratory movements.

The first group will be the Aniline derivatives. *Group I.*

ACETANILID or Antifebrine is a crystalline substance. Soluble in 200 parts of water, readily soluble in alcohol or ether. Dose 0.200-0.500. As much as 4.000 in twenty-four hours. As the crystals are tasteless it is best administered in powder form without any corrective.

Uses. In severe headache, scarlatina, measles, typhoid fever, phthisis, articular rheumatism and other inflammatory fevers and in obstinate vomiting especially after the use of an anesthetic. The

fall in temperature is noticed in about one hour and may last ten to twelve hours, and is a result of the profuse sweating. For analgesic purposes give in 0.500 doses and repeated two or three times per day if necessary.

Untoward effects. Moderate doses continued for a long time may be followed by collapse and death. After large doses pronounced cyanosis is often observed.

EXALGINE, or Methyl Antifebrin, closely resembles acetanilid or antifebrin in its effects and is given for the same purposes. It is very insoluble in water and is given in powder form for the relief of neuralgia, rheumatism and other painful affections. Dose 0.500 two or three times a day.

PHENACETINE. Odorless and tasteless white crystals. Used for the same purposes as antifebrin. Especially valuable for its analgesic effect. Dose same as antifebrin. Untoward effects same as antifebrin.

Belonging also to this group are

PARABROM ACETANILID, Asepsine or Antiseptine, insoluble in water, and METHACETINE, soluble in water, similar to phenacetine and used for same purposes.

BENZANILID. Very generally used as an antipyretic for children. *produces less collapse than any of its group.*

ANTI-KAMNIA. One of the newer remedies consists mainly of acetanilid in combination with sodium bicarbonate, caffeine and tartaric acid. *Only ignorant physicians use it.*

Group II.

BENZOIC ACID GROUP. Benzoic acid, shining crystals, soluble in 400 parts water. With alkalis it forms easily soluble salts.

U. S. P. contains the salts of sodium, soluble in two parts, lithium, soluble in three parts, and ammonium soluble in five parts of water.

Free benzoic acid is not used much except once in a while as an expectorant. The salts are used as antiseptics in diseases of urinary tract. Dose 1.000-4.000, as much as 10.000 per day. Formerly used as an antipyretic, now used as an antiseptic.

Group III

PHENOL GROUP. PHENOL or CARBOLIC ACID consists of crystals melting at 40° C. If treated with 5% water it liquefies. The most concentrated watery solution is from 5 to 6%. A 10% solution is quite impossible as it will be cloudy and carbolic acid will be deposited in a few days.

Its main use is as an antiseptic. In concentrated solutions it acts as an irritant and severe caustic, producing sloughs when

the application is too prolonged. Carbolic acid is absorbed from the unbroken skin and mucous membranes, often causing poisoning. It is excreted with the urine in the form of glycuronic acid and other decomposition products. *Carbolic acid urine is black.*

Official preparations are

UNGUENTUM ACIDI CARBOLICI. Contain 5% of acid.

GLYCERITA ACIDI CARBOLICI. Contain 20% of acid.

Carbolic Acid has been used internally on account of its antiseptic and antipyretic properties, but this use has been abandoned of late. Internally it is best given in pill form. Dose ~~0.010~~ *up to* 0.060.

ASEPTOL or Acidum Sozolicum is a brown, strong smelling liquid used externally as a substitute for Phenol. It is said to be less irritating and less toxic than carbolic acid.

SOZOIODOL. Its sodium compounds are easily soluble in water; the potassium ones with difficulty. Besides these there are in the market compounds of lead, silver, zinc, lithium and mercury. It is mostly used externally for antiseptic purposes, especially in pathological condition of the skin and mucous membranes. In eczema, dry catarrh and badly healing ulcers it may prove of value.

ZINCI SULPHOCARBOLAS or Sulpho Carbolate of Zinc is a substance freely soluble in water used, as an antiseptic externally especially in cases of indolent ulcers and subacute inflammation of mucous membranes in one-half to two per cent. watery solutions applied locally.

RESORCIN. Crystals very soluble in water, of peculiar odor and disagreeable taste. Only used for antiseptic purposes. May be given internally to disinfect the digestive tract. Dose 2.000-^{0.20-0.50} 5.000. Externally in form of powder or concentrated solution may be used as a caustic. One to two per cent. watery solutions are used as injections for rectum, vagina and urethra.

PYROGALLOL or Pyrogallic Acid, crystalline, soluble in two parts of water. Used in the form of ointment externally, especially used in eczematous condition of the skin, and in psoriasis but only when the patches are small. It turns the skin brown, which may be removed with benzine. A 20% solution acts as a caustic. *Used to dye hair.*

Caution. It should never be used over large surfaces as when absorbed into the blood, it is very poisonous causing vomiting,

purging, bloody urine and general depression. Use first small surface, and as this heals on another small area, and so on until the entire surface is well.

Group IV

SALICYLIC ACID AND ITS DERIVATIVES. SALICYLIC ACID is white crystalline needles soluble in 450 parts of cold water, fourteen parts of hot water and four parts of alcohol. Its solubility can be greatly increased by adding to it some phosphate or acetate of sodium. The real solubility of acid is not changed, the apparent increase being because of the formation of salicylate of sodium. It should be used in the form of powder or watery solution. The free acid is likely to cause vomiting, so one of its salts is substituted such as

SODII SALICYLAS, a white amorphous powder readily soluble in water.

LITHII SALICYLAS, very soluble in water. Dose for both salts is from 5.000-15.000 per day, of free acid 4.000 in twenty-four hours.

OLEUM GAULTHERIAE, or oil of wintergreen, volatile oil of very penetrating odor consisting mainly of methyl salicylate. Dose 0.060-0.300. Official preparation of this is

SPIRITUS GAULTHERIAE. Dose 4.00-8.000.

SALOL, or PHENYL SALICYLATE. Crystalline substance almost insoluble in water. It is not absorbed in the stomach, but is split up in small intestine into phenol and salicylic acid. It may be toxic even in small doses.

SALOPHEN. Is not absorbed by the stomach but splits up in the small intestine into its components, salicylic and acetyl amido phenol and is therefore less dangerous, as amido phenol is said to be non-toxic.

In the last five years there have also been prepared Malakin and Salokol. These are salicylic derivatives and are split up in the small intestine into the components.

Uses of salicylic and derivatives. Free salicylic acid is used externally as an antiseptic. Many surgical dressing contain the free acid. Strong solutions are used to destroy parasites. A solution containing 10% of salicylic acid, 24% cannabis indica and collodion is used to remove warts and epidermis, being applied with a brush. Sodium salts are mixed with starch and used to suppress excessive sweating, especially of the hands and feet. Salicylic acid is used internally in acute inflammatory rheumatism. In many cases it acts promptly in relieving pain, reducing the swelling and temperature.

Many physicians believe it is a specific for rheumatic fever, others are more skeptical about it. It decreases heat production and increases heat dissipation thus reducing the temperature. The free acid often causes vomiting, and for that reason one of the official salts is used, but even the sodium salt sometimes causes vomiting, and bicarbonate of soda is added to it to neutralize the acidity in the stomach and prevent the vomiting. The sodium salt is given in 1.000 doses and repeated every hour or two until 10.000-15.000 are used per day. It is gradually ~~in-~~ decreased until the fever and sweating disappear and continued about eight days after the normal temperature is reached. Heart complications and relapses are not so apt to occur with the salicylate treatment on account of the shortened course of the fever. It is liable to cause profuse menstruation, and therefore should not be used when menstruation is expected.

The untoward effects from its use are nearly as common as with quinine. The symptoms are giddiness, buzzing in the ears, partial deafness, headache, stupor and sometimes delirium. Collapse may be very marked and often hemorrhage from the gums and other mucous membranes occurs. It has a depressant effect upon the respiration and they may fall as low as eight per minute. The rule is to stop as soon as patient complains of symptoms--buzzing in the ears, deafness, etc.

Salol and the other compounds which are not absorbed in the stomach are mainly used to disinfect the intestinal tract and as they are split up in the small intestine they disinfect it nearly throughout its entire length. Sometimes free salicylic acid is found in the faeces showing that the whole tract is disinfected. Small doses stimulate the respiratory centre. Formerly its analgesic properties were made use of mainly to relieve pleuritic pains.

The first signs of its toxic effect may be seen in a dark coloration of the urine due to carbolic acid and when this is seen its administration must be stopped as it is being pushed to the limit.

The next group consists of Antipyrine and Phenylhydrazine. This is mainly a chemical classification.

Group V.

ANTIPYRINE. White nearly tasteless crystals, very soluble in water, chloroform and alcohol. 5 - 45

SALIPYRINE is Antipyrine and Salicylic acid.

RESOPYRINE is Antipyrine and Resorcin.

PYRODINE is a derivative of phenylhydrazine.

ANTITHERMINE is phenylhydrazine and glycuronic acid.

HYPNOL is a compound of chloral and antipyrine.

These drugs are all phenylhydrazine compounds and of them ANTI-PYRINE is the one mainly used. It is used externally as a haemostatic. Internally it is given in many febrile conditions in doses from 0.500-1.000 and as much as 5.000-8.000 in twenty-four hours. As an analgesic it is given in doses 1.00-1.500 repeated once or twice if necessary. As it is nearly tasteless it is given usually in powder form or in a watery solution.

Untoward effects are not so marked as with salicylic acid group but marked cyanosis has often been seen and cases of death have occurred from its use.

Group VI.

Next main group is CHINOLINE and its derivatives.

CHINOLINE is a liquid, smells like tobacco, colorless when pure, ~~easily~~ ^{not} soluble in water and with acids forms soluble salts. Used externally as a gargle in cases of diphtheria in proportion of 1-500. Internally given only in the form of salts. The tartrate is used in diphtheria and whooping cough. 5 up to 45.

KAIRINE has been used as an antipyretic medicine before others were known. It is a coal tar product. Its effects are very temporary. 1st antipyretic used.

THALLINE. It occurs in colorless or yellowish crystals, soluble in water, alcohol and ether. It forms salts with acids. The sulphate is mainly used in doses 0.100-0.200. 2d antipyretic used.

The last two substances are used in febrile diseases of children.

Group VII.

CHRYSAROBINE is a yellow crystalline powder obtained from a Brazillian tree. Commercially it is known as Goa Powder. It is slightly soluble in water and mixes well with fats, oils and vaseline. Soluble in caustic alkalis with a yellow color. The alkaline solution upon shaking rapidly takes up oxygen from the air and forms chrysophanic acid.

Chrysarobine is only used externally in the form of an ointment. It is often mixed with flexible collodion. UNGUENTUM CHRYSAROBINI is a five per cent. ointment of chrysarobine. It is used quite extensively in psoriasis with very good results. Also used where there is an abnormal growth of the epidermis and in parasitic diseases of the skin, as ringworm, etc. The drug should never be applied to face or genitals. It stains the skin dark brown but this can be removed with benzine.

[illegible]

Group VIII.

ICHTHYOL CROUP. ICHTHYOL. Under this name is understood the crude oil obtained from bituminous rocky deposits found in the mountainous regions of Tyrol and also the products of the action of concentrated sulphuric acid upon this oil. The product only is used in practical medicine. It is a brown syrupy liquid having quite an offensive smell. Soluble in water. Internally it has been recommended for fermentation of the stomach. It is mainly used externally in different skin eruptions. Application is made in the form of ointment, containing from 5 to 50% of ichthyol. It is used for itching skin and very satisfactory results have been obtained in relieving rheumatic pain and even reducing the swelling. It is the best treatment for erysipelas.

TYROL is a substitute for above. It is also a liquid.

Next group comprises Group IX.

CREOSOTE, GUAIACOL and CREOLINE. Creosotum is a clear oily liquid having a smoky odor. It is obtained by distillation of wood tar, especially that of the beach tree. It should not contain carbolic acid. It acts locally as an irritant to skin and mucous membranes. It was formerly used internally as an antiseptic before the introduction of carbolic acid. Given internally mainly in consumption and in some pathological conditions of the intestinal tract. Dose ~~0.200 as much as 1.000 per day~~ ^{single up to 1.000 gram.}. As a rule given in a gelatine capsule or in the form of an emulsion. *It acts best in tubercular patients.*

CARBONATE OF CREOSOTE, or Creosotal, contains about forty per cent. of creosote. It is a thick oily powder, insoluble in water, but soluble in oils and is said to be less irritating to the stomach than creosote. Used internally in tuberculosis.

GUAIACOL is a colorless liquid with an aromatic odor. Dissolves with difficulty in water, and is used as a substitute for creosote.

GUAIACOL CARBONAS is a white crystalline powder, odorless, tasteless and insoluble in water. Dose 0.300-1.500.

GUAIACOL SALICYLAS is guaiacol and salicylic acid. It is analogous to salol.

BENZOSOL is a compound of guaiacol and benzoic acid.

All the members of this group are used in the treatment of consumption.

CREOLINUM, or Creoline, is a coal tar preparation. Brown syrupy liquid which with water forms a milky emulsion of a weak alkaline reaction, the emulsion remaining homogenous with 12%

time and of

of the drug. Externally it is used as antiseptic and deodorant to disinfect wounds, hands and instruments. The hands, after being dipped into a solution containing it, become quite slippery. Also used in a 2% solution for injections into the vagina, urethra, etc., and sometimes as a gargle in proportion 1-500.

LYSOLUM, a substitute for creoline, is a clear solution, soluble in water but does not form a milky solution. It is used in a 1-2% solution externally for same purposes as creolin.

Group X.

NAPHTHALINE GROUP. NAPHTHALINUM, prepared from coal tar, colorless, shining crystals having an odor resembling coal tar itself and has a burning taste. Insoluble in water but soluble in fifteen parts of alcohol, very soluble in ether and oils and volatilizes at ordinary temperatures.

Internally it is used for disinfecting the gastro intestinal tract in cases of catarrh and tuberculous diarrhoea. Dose ~~0.5-1g~~ ~~0.5-1g~~ ~~0.5-1g~~ 0.5-1g, repeated a few times if necessary. In dysentery give 6.000-8.000 per day. Externally a 10-12% solution is used in scabies.

BETA NAPHTOL, or Naphtol, colorless crystals very soluble in alcohol, ether, caustic alkalies and in 1000 parts of water.

^{Ex}ternally it is used in a 5 or 6% alcoholic solution for skin eruptions, like psoriasis, eczema and scabies, or it may be used in the form of an ointment. Internally it is used to disinfect the gastro-intestinal tract. $\frac{1}{2}$ up to 5 1-2-3 g.

ASAPROL is a colorless crystalline powder soluble in one and a half parts of water and three parts of alcohol. Use same as the other members of this group.

Group XI.

PYRIDINE GROUP. PYRIDINE is a colorless liquid, peculiar odor, very soluble in water, alcohol and ether. Externally it is used in cases of dyspnoea and asthma by placing three to five grams on a plate, ~~setting on fire and inhaling the fumes.~~ *evaporate in room*

IODODUM, or TETRAIODOPYRRHOL, is a pyridine derivative, and is a yellow powder, odorless and tasteless, nearly insoluble in water and contains about ninety per cent. of ~~iodine~~ ^{iodine}. Externally as an antiseptic and substitute for iodoform.

Internally as substitute for potassium iodide in the treatment of syphilis.

Group XII.

TAR COMPOUNDS. PIX LIQUIDA or Tar is obtained by destructive distillation of the different species of pine wood and is a thick brownish-black semi-liquid mass, slightly soluble in water, soluble

in alcohol, oils and solutions of sodium and potassium hydrate. Preparations are

OLEUM PICIS LIQUIDAE. Dose 0.050-0.300.

SYRUPUS PICIS LIQUIDAE is sweetened tar water. Dose ~~4.000~~ 15.000. *To kill worms 2-3 gms.*

UNGUENTUM PICIS LIQUIDAE contains equal parts of tar and suet.

Externally used in chronic skin diseases, especially psoriasis, chronic eczema, and different parasitic skin affections. If applied over large surfaces, it may be absorbed and produce poisonous symptoms the same as antipyrine and other tar products. It may produce tar acne, that is pustules with a black centre. It is very rarely used internally, and then only in chronic bronchitis and pulmonary tuberculosis.

Group XIII.

THYMOL GROUP. THYMOL is a phenol which occurs in different vegetable volatile oils. It consists of large colorless crystals, having an aromatic odor and pungent taste, liquefying when triturated with equal parts of camphor or chloral hydrate, scarcely soluble in water but very soluble in alcohol, ether, fats and oils.

Uses. It has been used externally as a substitute for phenol on account of its less offensive odor. Surgical dressings are often impregnated with it. Alcoholic solutions are used as mouth washes and gargles. It is also used for inhalation and as a stimulant in skin eruption. Internally it is given in catarrh of the stomach and intestinal diarrhoea on account of its antiseptic action. Dose 0.060-0.200 repeated two or three times per day. As an antiparasitic it has been used to expel *Anchylostoma duodenalis* from the small intestine.

ARISTOL or DITHYMOL IODIDE, is an amorphous brown powder, insoluble in water and glycerine, easily soluble in alcohol and oils. Used externally in 3 to 10% solutions in the form of salve and ointment for skin affections and as a substitute for iodoform in cases of soft chancre.

MENTHOL or Mint Champhor, is found chiefly in the different varieties of peppermint oils, and consists of colorless crystals which have the odor of peppermint, slightly soluble in water, freely so in alcohol, ether and oils. Liquefies when triturated with an equal quantity of phenol, thymol or chloral hydrate.

Used to produce local anaesthesia and may do good, when rubbed over the course of the nerve in certain cases of neuralgia. Internally it is given in doses of 0.030 to 0.100 in cases of pregnancy to relieve vomiting and nausea. It has also been used in tuberculosis.

Small yellow crystals.

Used internally in cases of cancer of stomach.

We come now to the fatty series of carbon compounds used as antiseptics; the above thirty or so belong to the aromatic series.

Group XIV.

IODOFORM has a persistent odor and unpleasant taste. It is soluble in sixty parts water, but freely soluble in alcohol, ether and oils. It contains ~~about~~^{over} 90% of iodine. It has an unpleasant odor and has been mixed with a large variety of substances to disguise it. Dose 0.060-0.200. As much as 1.200 per day. *10-15 gr.*

UNGUENTUM IODIFORMI should always be freshly prepared.

SUPPOSITORIA IODIFORMI each contain about 0.15, of Iodoform.

Internally it has been used in syphilis in single doses of 0.500, and up to 8.000 per day.

It acts like potassium iodide, but has very disagreeable external properties and for this reason has been largely abandoned.

Externally in ulcerations, especially those of syphilitic *10-15 gr.* origin, the powder is sprinkled over the sore and it may be used up to eight grams per day, but above this may produce poisoning.

Symptoms of poisoning are intestinal irritation, dilated pupils, hallucinations, rapid pulse and lastly severe collapse.

FORMALDEHYDE, or formaline, is a gas, soluble in water. The commercial article contains about 40% of it. *CH₂O*

Used as a powerful disinfectant and preservative. A 1% solution is sufficiently strong for surgical antiseptics. When added to milk in proportion of 1-30,000 it keeps it in a good condition. It is also used to disinfect large rooms. *Saves milk from souring 2 wk.*

TRIOXYMETHYLENE is a crystalline substance and possesses *(HCHO)₃* antiseptic properties.

UROTROPINE is formaldehyde and ammonia. It has been used considerably of late to disinfect the urine.

COLCHICUM, derived from both the seeds and corn of colchicum antimmate, a plant growing in Europe. It is a nitrogenous substance. The official preparation is

VINUM COLCHICI RADICIS. Dose 0.600-2.000.

Colchicum is a very toxic substance 0.001 per kilo of body weight of dog is a lethal dose. Small doses stimulate the intestinal tract, probably by stimulating the motor ganglia, and produce vomiting and diarrhoea. After a primary stimulation there is a depressant effect upon the central nervous system, and later there is a paralysis first affecting the hind legs and then the fore legs in animals. It also decreases the sensibility

Gum Campbr
Laurel "

of the skin. The respirations, while full and deep at first, are later very much depressed and death due to their cessation. It has no direct effect upon the heart.

All its actions are slow in coming because it is very slowly absorbed and a larger quantity of the drug does not seem to bring on the action quicker.

In human beings, if sufficiently large doses are taken, the same results are seen as in warm blooded animals, that is, vomiting and diarrhoea, later retching and tenesmus and death, due to the cessation of respiration.

The crude drug has been used in gout and rheumatism, but whether it does any good is more than doubtful. If it does good it can only be explained by the depressant effect it has on the sensory nerves; but, for this purpose, drugs of the aromatic series act much better. It should never be used for gout or rheumatism.

CAMPHOR and Derivatives. Belonging to this group are

CAMPHOR, BORNEO CAMPHOR, MONOBROMATED CAMPHOR, Camphoric Acid and probably many other volatile vegetable substances as menthol, thymol, etc., could be classed with these only their action is not so well studied.

CAMPHORA is a colorless white, dull substance, pulverizes readily if alcohol or ^{a solution} ether is sprinkled over it. It has a characteristic odor and a pungent aromatic taste, volatilized very slowly at ordinary temperature. It is only the odor that is very strong. Soluble in 1,000 parts of cold water, very soluble in alcohol, ether, chloroform and oils. Liquefies when triturated with thymol, menthol, phenol or chloral hydrate. It is very combustible, burning with a flame and a great deal of smoke. Dose 0.100-0.200 and as much as 1.200 in twenty-four hours.

AQUA CAMPHORAE, 10.000 to 60.000. *only Sub cut injection up to .05 -*

SPIRITUS CAMPHORAE, 2.000 to 4.000.

LINIMENTUM CAMPHORAE.

CAMPHORA MONOBROMATA. White crystalline substance of a camphoric odor and taste, permanent in air, almost insoluble in water, but soluble in alcohol, ether, chloroform and oils. Dose ~~0.050~~ *0.100. like camphor*

ACIDUM CAMPHORICUM white crystals soluble in hot water, alcohol ether and fatty oils, almost insoluble in cold water. Dose ~~0.600~~ *2.000. like camphor*

CAMPHOR acts locally as an irritant, dilating the vessels of the skin and causing a sensation of warmth. Later it depresses the sensory nerves acting as a local anesthetic. Also acts as a feeble antiseptic preventing putrefaction. Upon mucous membranes of the mouth, oesophagus and stomach it acts as a local irritant causing an increased flow of saliva in the mouth and a burning sensation in the stomach. Long continued use may cause inflammation of mouth and a severe gastritis.

In warm blooded animals
It acts as a stimulant to respiration and circulation and excites the whole central nervous system and as a sequel in warm blooded animals, restlessness follows its administration. Larger quantities may produce epileptiform convulsions which may be repeated again in the first four or five hours. Collapse never follows the administration of camphor. Febrile temperature, especially of septic origin, is much reduced by it. In excessive doses a narcotic effect may be produced, causing stupor and even unconsciousness.

Powdered camphor is very slowly absorbed from the intestinal canal and therefore is best given in oily emulsion or oily solution, and even then is not rapidly absorbed because it is not very volatile. After absorption it acts directly upon the heart muscle, and also as a stimulant to the respiratory centre.

It is used because of its local irritant effect in badly healing ulcers and skin eruptions. The irritation produces new life in the part and probably the feeble antiseptic powers aid its beneficial action.

In painful affections such as sprains, rheumatism, etc., it is used in the form of a liniment.

Internally it may be used to disinfect the gastro intestinal tract. Because of its dilating effect upon superficial vessels it is very frequently used in colds to relieve the congestion. Its stimulating effect on heart and respiration is made use of in collapse. In cases of collapse the usual custom here is to administer it by the mouth, but in Europe it is frequently given subcutaneously dissolved in ether, from 0.050 to 0.100 of camphor in 5.000 of ether.

MONOBROMATE has a stronger narcotic effect than camphor itself, and is used only as a nervous sedative.

CAMPHORIC ACID is used only to decrease night sweats in

Protoplasmic frissons affect central nervous system .

phthysical patients. It decreases the secretions probably by acting directly upon the nerves that control them.

AGARICUS, Touchwood or Punk is a fungus growing on a Southern tree. The fungus contains different amorphous substances which produce the drastic effects and at the same time decrease the night sweats of phthisis. This decrease in sweat is the result of the action of Agaric Acid upon the nerve filaments of the sweat glands. It does not act upon the parenchyma of the gland. It is used in the form of Agaricin, the alcohol extract of the drug. Dose 0.030-0.100. It should be given in small doses about three hours before retiring. It acts as a depressant to sweat glands but does not influence lachrymation or salivation.

HEART POISONS. Chemical substances which influence the heart muscles directly are called heart poisons and are any chemical substances which produce in the living organism certain changes in its function. These changes may be either physiological or toxicological. The substances belonging to this group are non-nitrogenous with one exception. Some are crystallizable glucosides, others crystallizable but not glucosides and the rest are amorphous substances with unknown character and composition. The greater part are derived from the vegetable kingdom but some substances are found in the animal kingdom with almost identical action. A substance extracted from the skin of toads called Phyrine, and one from cockroaches, Antihydropsin, have a similar action to Digitalis. An extract of the supra-renal gland seems to affect the heart in the same way.

DIGITALIS, Digitalis Purpura or Fox Glove contains several different heart poisons as follows.

DIGITALIN and DIGITALEIN are glucosides, the first insoluble and the latter soluble in water. Both are soluble in alcohol.

DIGITOXIN. This is not a glucoside, and is the most toxic of the group. These three are extracted from DIGITALIS PURPURA.

DIGITONINE is also extracted from it, but has no action upon the heart and seems rather to antagonize the action of above.

DIGIRESIN and DIGITOXIRESIN. Two resins. They are important only so far as they cause convulsions by stimulating the spinal cord.

ERYTHROPHLEIN is the only alkaloid of the group. It causes convulsions by stimulating the spinal cord.

Besides those extracted from digitalis itself are

HELLEBOREIN, EROXYNUM, ANTIARIN and THERETIN. These four are glucosides and are crystallizable.

APOCYNIN AND STROPHANTIN are crystallizable but not glucosides. CONVALLAMARIN. From the lily of the valley. Apocynein scillain, and nereine from the oleander tree, are amorphous glucosides.

The heart poisons have a direct action upon the heart. It may be that the muscular system is affected by them, but this has not been proven. Its action is upon the heart only and no symptoms are seen in any part of the central nervous system. In cold blooded animals the heart stops in systole, the elasticity of the heart muscle is changed and it can not be brought back to diastole, but if we start the heart mechanically with liquid normal pulsation will take place. If we inject more of the heart poison the muscle takes on a condition of rigor, that is, there is a coagulation of the muscle and no mechanical means will bring pulsation back. In warm blooded animals the heart does not stop in systole, it simply becomes paralyzed.

The effect of digitalis was shown upon a recently exposed frog's heart which was beating normally. A few drops of digitalis toxin was placed upon it. The heart's action became slower and the systole was lengthened, that is, it remained contracted for a longer period than normal. A few more drops were added and the contractions became irregular. The apex remained contracted during both systole and diastole, and the beating of the auricles and ventricles were not synchronous. Irregular contraction waves could be seen passing over the heart's surface. The auricles would contract and the contraction wave would pass down to the ventricle while the auricle was expanding. Sometimes the auricles would contract twice while the ventricle was contracting once. The heart finally stopped in systole with the walls strongly contracted.

Effect of Digitalis on a dog. A dog was narcotized with morphine and chloral hydrate to decrease blood pressure. A little of the heart poison was injected slowly. The blood pressure was seen to rise while the pulse rate fell. Some more was injected and the blood pressure was seen to rise still higher while the heart's action became rapid. Still more was injected and the pulse rate and blood pressure became irregular with the subsequent rapid fall in blood pressure due to paralysis of the heart.

The action of Digitalis may be divided into four stages:

Stage I. The pulse volume is increased and the pulse rate is reduced.

Stage II. If more of the poison is injected the blood pressure rises still more but the pulse rate will be increased.

Stage III. In warm blooded animals there is a peristaltic movement passing over the heart but the blood pressure is still very high. This is partly due to paralysis of the vagi and the poisonous effect upon the heart.

Stage IV. The blood pressure falls very rapidly, the pulse is very irregular and the heart will finally come to a standstill due to paralysis.

In therapeutics the first stage is wanted; that is, an increase of blood pressure and a reduction of the pulse rate. The first is brought about by direct stimulation of the heart muscle itself, and the decrease of pulse rate is due to the stimulation of the vagi both centrally and peripherally and does not occur if the vagi are cut or paralyzed with atropine.

All the substances of this group have a local action and if taken internally may cause vomiting. Their diuretic influence is simply due to the increased blood pressure. They do not act upon the kidney epithelium and urine will be increased only in those cases when urinary matters are increased in the system due to inefficiency of the heart's action. The term Diuretics applied to heart poisons is wrong, as normal man never excretes more urine as a whole although more may be passed for a few hours after its administration. Digitalis is given in many forms as the Infusion, Extract, Leaves and Tincture. The best way to administer it would be in the form of a chemically pure substance, but as yet we are unable to do this as the active principle is not known.

Digitoxin has been recently tried with good results in doses of 0.0001 dissolved in alcohol. It is very insoluble in water and has very marked accumulative effects so that it should never be given this way unless ample time is allowed for its elimination.

All the members of the digitalis group especially the preparation of digitalis itself are slowly eliminated, therefore its accumulative properties are marked and must be considered in the prescribing of the drug. The official preparations of the group are

DIGITALIS FOLIA. Dose 0.030-0.200.

EXTRACTUM DIGITALIS FLUIDUM. Dose 0.030-0.200.

INFUSUM DIGITALIS. Dose 4.000-~~16.000~~. 2x

TINCTURA DIGITALIS. Dose 0.300-2.000.

TINCTURA STROPHANTHI. Dose ~~0.100-0.600.~~ ~~2.000.~~

EXTRACTUM SCILLAE FLUIDUM. Dose 0.060-0.300.

TINCTURA SCILLAE. Dose 0.300-2.000.

Helleborin in small doses gives no results. In doses large enough to produce the characteristic results it causes a severe gastric irritation and so is not used.

Convallamarin. The same results with this as with helleborin.

Digitalis is used in valvular disease of the heart, especially mitral and aortic insufficiency. In myocarditis, nervous and palpitating heart it may also be used, but patient must be very carefully watched. In these latter conditions it should be given in small doses only, and if the pulse increases at first, its use must be stopped. It may be used as a diuretic if the dropsy is due to HEART trouble, but not if it is due to kidney disease. In disturbances of the lungs, such as chronic congestion, emphysema, pneumonia, tuberculosis, hyperaemia and oedema of the lungs it may also be used to overcome the increased pressure in the lungs and to fill the systemic arteries properly.

Caution. Very often the amount of heart poison given is too large. This is especially so in myocarditis, dilation, palpitation and pericarditis, where they should always be used with the greatest precautions. In these conditions physicians frequently prescribe 20, 30, or 40 drops per day, and as part of the muscle is degenerated and cannot work the rest of it is strained and often gives way under the strain and the machinery stops. In these cases death is said to be due to heart disease, but it is really due to over stimulation. More deaths are caused every year by the misunderstood use of digitalis and its derivatives than any other single drug in the materia medica.

The first stage, that is, where the pulse rate is lowered and the blood pressure increased, is the one desired in the therapeutic use of digitalis. If the pulse rate increases under digitalis it is best to give it up. By digitalis is meant all the substances of this group.

LOCAL DRUGS, that is, drugs used for their local action only, which action is not the result of their absorption into the system but is the effect produced when they are applied directly to any portion of the body. They may also have a general as well as a local action but this general action is not desired and is avoided as far as possible.

They may be applied directly to skin and mucous membranes or internally for their direct action upon the alimentary tract or to be absorbed and act locally upon the urinary tract when excreted by the kidney. Many of these drugs are not known chemically and still less physiologically. They may be divided into two classes:

- I. Drugs used on account of their physical properties.
- II. Drugs used on account of their irritant properties.

The first group consists mainly of fats, fatty oils and paraffines. All these substances as a rule are liquid or semiliquid at ordinary temperature or becomes so when rubbed into the skin.

They are used to make the skin softer and more resistant to external injuries, as protectives when the external skin has become abraded and as solvents for such drugs intended to be applied locally. Watery solutions of volatile substances do not pass through the unbroken skin if it contains the normal amount of fat. Alcoholic solutions will be absorbed if the fat is first removed from the skin. Oils and fats pass through the skin and substances mixed with them will be absorbed at the same time, for example the antisypilitic treatment by inunction in which the mercury is dissolved in the fat and rubbed into the skin. A certain amount of fat may be given in this way to very delicate persons and act as food.

OLEUM OLIVAE or olive oil, often falsified with cotton seed oil which is cheaper. Used in massage, and for this purpose is preferable to vaseline and as basis for many plasters and ointments. Where a fat or oil is not contraindicated it is one of the best demulcents in cases of poisoning from corrosive drugs.

SAPO, or sodium oleate, is prepared from olive oil and soda. From this is made

EMPLASTRUM SAPONIS, consists of ten parts of soap and ninety parts of lead plaster.

LINIMENTUM SAPONIS, or opodeldoc, consists of camphor, soap, alcohol, water and one of the volatile oils. It is largely used for rubbing stiff muscles, sprains, etc., or as an excipient to carry more active external remedies as aconite or belladonna.

EMPLASTRUM PLUMBI or lead plaster is simply a mixture of olive oil and lead oxide.

SAPO MOLLIS or sapo veridis or soft soap is made of potash and olive oil and strictly speaking is the oleate of potassium.

LINIMENTUM SAPONIS MOLLIS is made from above. It is used a

Does not become rancid.

" " evaporate.

Increases peristaltic movements.

good deal by dermatologists where a cleansing stimulating application is needed. Soap is used mainly as a protective,

GLYCERINUM is a liquid obtained by the decomposition of animal or vegetable fats or fixed oils. It is a clear liquid of a syrupy consistency, oily to the touch, odorless and very sweet to the taste. Soluble in all proportions in water or alcohol but insoluble in ether, chloroform and oils.

SUPPOSITORIA GLYCERINI is made from glycerine, sodium carbonate and stearic acid. Each one containing about six grams of glycerine and is used as its name indicates.

GLYCERITUM AMYLI or glyceride of starch. It has no value over plain glycerine.

Glycerine is also used as an enema or rectal injection. It stimulates peristalsis and evacuation of the bowels will occur in about half an hour. It is mainly used as a solvent for substances applied to the skin. It also forms a good solvent for bromine, tannic acid, alkalies, etc. Externally it is used as an efficient remedy for chapped hands. A mixture of glycerine and water is an excellent application to lessen the dryness of the mouth from fever or other causes.

OLEIC ACID is a brownish yellow liquid, used as a substitute for olive oil. Penetrates the skin more readily than the fixed oils or fats. It is therefore employed as a solvent and vehicle for more active remedies intended for application to the skin in the form of oleates. The most important of these are

OLEATUM HYDRARGYRI.

OLEATUM ZINCI.

OLEATUM VERATRINAE.

An expensive substitute for olive oil is

OLEUM AMYGDALAE. This oil is expressed from bitter almonds. It is pale yellow in color and of a nutty taste.

OLEUM LINI or linseed oil or flaxseed oil. Is a viscid yellow oil expressed from flaxseed. Mixed with equal parts of lime water it forms what is known as

CARRON OIL which is very generally used as a protective and soothing dressing for burns.

FLAXSEED or linseed meal is almost universally employed for making poultices when a warm moist application is desired. The portion of the poultice which is applied directly to the skin should always be greased in order to prevent sticking to the part.

OLEUM GOSSYPII SEMINIS or cotton seed oil. Is a pale yellowish

liquid having a nut like taste and is used as a substitute for olive oil.

OLEUM THEOBROMATIS, or cocoa butter, yellowish white substance with an agreeable taste. Obtained from the cocoa bean and does not become rancid from exposure to air. It is used mainly as the basis of suppositories.

ADEPS, or common lard, is used mainly in the form of the ~~extract~~.

ADEPS BENZOINATUS, or benzoinated lard, consists of lard fifty parts, benzoic acid one part.

CERATUM is a mixture of lard and white wax.

UNGUENTUM is a simple ointment consisting of lard and yellow wax.

SPERMACEI, obtained from the Sperm whale, is a white crystalline substance, which, on exposure to air, becomes rancid.

UNGUENTUM AQUAE ROSAE, or cold cream, consists of spermaceti, white wax, expressed oil of bitter almonds and rose water. It is used as the basis of many other ointments.

Skin Irritants

Drugs used on account of their IRRITANT PROPERTIES.

For irritation and counter irritation, organic drugs are mainly used. Some only irritate the skin slightly, others produce redness, sweating, a feeling of warmth and may lead to the formation of vesicles, etc. If the irritation is very severe there may be formation of pus and even necrosis of the tissue. It is only within the past fifteen years that these drugs have been grouped. The best classification is that of Schmiedeberg which is as follows: 1. Turpentine Group. 2. Mustard Oil Group. 3. Cantharides Group.

To the Turpentine Group belong all the turpentine oils which are readily volatile, and all volatile ethereal oils. The main characteristic of this group is their volatility. Any substance which is volatile and is confined is a skin irritant. The members of this group besides the different turpentine and ethereal oils are:

ARNICAE FLORES. The flower heads of the arnica montana, a plant found in the mountainous regions of Europe, Asia and America. From this is prepared

TINCTURA ARNICAE FLORUM.

OLEUM CAJAPUTI a colorless liquid having a peculiar odor.

OLEUM EUCALYPTI a colorless liquid of an aromatic odor.

If any members of this group are absorbed from the skin or mucous membranes constitutional symptoms are noticed, the blood pressure rises and respirations are increased and the central ner-

vous system is stimulated directly as well as reflexly. If large amounts are absorbed toxic symptoms will be produced. This group is a very large one and altogether consists of more than 200 substances.

The members of the Mustard Oil Group are volatile, like those of the Turpentine Group, and also possess special irritant properties. Their action is severe. They cause redness, dilation of the superficial vessels and a burning sensation of the skin, same as those of the first group, but in addition owing to their special irritant properties there is a formation of vesicles transudation of serum and if the action is prolonged necrosis will be the sequel, To this group belong mainly the Oil of Black Mustard (*Oleum Sinapis Nigrae*) of which the active principal is Allyl-Sulphocyanide which is not present in the seeds as a free oil but in the form of a glucoside called Sinigrin. Besides the glucoside the seeds contain the ferment, - Myrosin-which in the presence of moisture decomposes the Sinigrin setting free Potassium Sulphate, Sugar and Allyl Sulphocyanide. The most convenient way to use mustard is in the form of the prepared papers or

CHARTA SINAPIS. In which the mustard is previously spread upon the paper. When it is desired to use one of these the paper is simply moistened and applied to the skin, and in the presence of the moisture the ferment sets free the irritant from the sinigrin. Of the oil itself there is an official preparation,

LINIMENTUM SINAPIS COMPOSITUM, which contains oil of mustard, fluid extract of mezereum, camphor, castor oil and alcohol. Another substance which may be added to this group is

OLEUM SABINAE. It is a volatile oil and possesses special irritant properties. It is not much used for medicinal properties. It is not much used for medicinal properties only to produce criminal abortion. It acts as a decided irritant to the uterus producing a marked hyperaemia which may lead to abortion. On account of its powerful irritant properties it is a very dangerous drug to use.

Cantharides Group consists of non-volatile substances whose action is slow to come, but which action after its appearance lasts for a long time. This action, as they are non-volatile, is due to their special irritant properties. They will cause the same symptoms and results as the Mustard Oil Group. The effect will be local and not penetrate deeply into the tissues.

Their action is much slower than either of the previous groups,

Constitutional affect same as that of phenol.

as the turpentine and mustard oil groups may produce vesication within one-half hour, while with this group the results may occur only after two or three days. Their action is much quicker if they are mixed with oil, alcohol or soaps, as they pass more readily through the skin.

CANTHARIS, or ^{extracted} Spanish Flies, is a grayish brown powder whose active principle is a crystallizable substance which forms salts with alkalis which are very powerful irritants. If much of the drug is absorbed from the skin toxic symptoms may be produced such as vomiting, difficulty of breathing, unconsciousness and death on account of cessation of respiration. It may cause irritation of the kidneys and should always be used very carefully where there is any nephritic complication. Official preparations are

CERATUM CANTHARIDIS consists of cantharidis, yellow wax, resin, lard and oil of turpentine.

COLLODIUM CANTHARIDATUM, or Blistering Collodion, consists of cantharidis and flexible collodion.

TINCTURA CANTHARIDIS is an alcoholic solution of cantharidis. To this group also belong *local or internal use. Loss of appetite.*

MEZEREUM, a non-nitrogenous oil. It is extracted from the Daphne Mezereum a small shrub from two to four feet high. Its official preparation is Extractum Mezerei Fluidum.

CARDOL is a non-nitrogenous oil obtained from Anacardium Occidentale or Caju fruit. The fruit itself does not contain the oil which is found in the skin and cone, so that the fruit can be eaten without harm if the skin is first removed.

CAPSICUM, or cayenne pepper, contains two active principles, a resin and an oil. The U. S. P. contains

EXTRACTUM CAPSICI FLUIDUM. Dose 0.060-0.300.

TINCTURA CAPSICI. Dose 0.300-~~1.000~~ - ~~0.500~~ 2.500

EMPLASTRUM CAPSICI. For external use.

Skin irritants are used internally to stimulate the gastrointestinal canal.

RHUS TOXICODENDROL, poison ivy, or sumach, is a non-volatile oil. It causes a skin eruption which may not appear until from three to eight days have elapsed. As it is non-volatile the action is slow to come, but when it makes its appearance it will be very marked. One two-hundredths of a milligram of this will cause not only an irritation, but also in some cases a toxic dermatitis. If the oil acts too strongly it should be removed with

1. The first part of the paper is devoted to a discussion of the
theoretical aspects of the problem. It is shown that the
problem is equivalent to a problem of the theory of
differential equations. The second part of the paper is devoted to
the construction of a numerical algorithm for the solution of the
problem. The algorithm is based on the method of finite differences.
(The algorithm is described in detail in the Appendix.)

alcohol. Ointments and fats should not be used for this purpose as they dissolve it and so spread it over a larger area.

LOCAL DRUGS used as PURGATIVES. The so-called vegetable purgatives are not known chemically and cannot be classified in this way. Their physiological action is not well understood; some stimulate portions of the intestinal canal, others the entire length from the stomach to the rectum. As so little is known about their chemical and physiological properties they are better grouped according to their clinical actions. Clinically they may be divided into two classes: I. Purgatives. II. Drastics. This classification is simply on their quantitative and not qualitative action.

I. PURGATIVES. OLEUM RECINI, or Castor Oil. Expressed from the seed of an Indian plant. When freshly prepared it is nearly colorless. It is a fatty oil and passes unaltered from the stomach and is decomposed in the intestines. The seeds contain besides the oil a very toxic substance the composition of which is not known. It is supposed to be a toxalbumin but as yet has not been definitely isolated. Dose 8.-60. It is very often given in a capsule.

SENNA. The leaves of the different species of Cassia. The active principle is cathartic acid, an amorphous glucoside soluble in water.

EXTRACTUM SENNAE FLUIDUM. Dose 4.000-12.000.

INFUSUM SENNAE COMPOSITUM, or Black Draught, contains Senna, Manna, Magnesium Sulphate and Fennel. Dose 30.-60.

PULVIS GLYCYRRHIZAE COMPOSITUS, or Compound Liquorice Powder, contains Senna, Liquorice, Washed Sulphur, Oil of Fennel and Sugar. Dose 2.000-8.000.

PULVIS GLYCYRRHIZAE, or Liquorice Powder. Dose freely.

RHEUM, or rhubarb. The active principle is chrysophanic acid.

EXTRACTUM RHEI FLUIDUM. Dose 1.000-4.000.

PILULAE RHEI. Each pill contains about 0.150 of rhubarb. Dose 1-3 pills. *Also compo*

TINCTURA RHEI. Dose 4.000-8.000.

There are in the U. S. P. about twelve preparations of rhubarb, but the above are sufficient for all practical purposes.

FRANGULA, or Buckthorn. The official preparations of this is

EXTRACTUM FRANGULAE FLUIDUM. Dose 2.000-8.000.

ALOE. There are two forms of aloes in the U. S. P. named according to their place of growth.

ALOE BARBADENSIS, from the Barbadoes Islands.

ALOE SOCOTRINA from northern Africa.

All the different species contain the same active principle aloin, but curiously enough it does not act as well as the crude drug.

It causes hyperaemia of the intestines and uterus and should be avoided in piles as it only aggravates these, and during menstruation, as it often increase the menorrhagia. It should also be avoided during pregnancy as it may cause abortion.

EXTRACTUM ALOES. Dose 0.030-0.200.

PILULAE ALOES. Dose 1-3 pills. .12g

TINCTURA ALOES. Dose 1.000-4.000.

PILULAE ALOES et MYRRHAE. Dose 1-3 pills.

PILULAE ALOES et FERRI. Dose 1-3 pills.

Aloes is used to a large extent in the different pills and makes an excellent purgative, except under the conditions named, viz: In piles, catamenia and pregnancy.

II. DRASTICS. Drastics acts quicker and cause more watery stools than purgative. They are differentiated only by their quantitative action. If used for a long time they are apt to cause inflammation of the intestine. Whether they act through the nerves or the muscular tissues, or both, is not certain.

SCAMMONIUM is the resinous exudation of the convolvulus scammonia. The official preparation is

RESINA SCAMMONII. Dose 0.060-0.500. It is rather apt to gripe.

JALAPA is the root of the Ipomoea Jalapa, a native of Mexico. It contains two resins.

EXTRACTUM JALAPAE. Dose 0.100-0.500.

PULVIS JALAPAE COMPOSITUS sometimes called

PULVIS PURGANS composed of Potassium Bi-tartrate and Jalap.
Dose ~~1.000-4.000.~~ 0.1 - 0.4

RESINA JALAPAE. Dose 0.060-0.300.

The stools produced by Jalap are quite watery without much griping. Used in ascites to draw off the liquid.

OLEUM TIGLII, or Croton Oil, is a fixed oil expressed from the seeds of the Croton Tiglium, an Indian plant. It is a strong irritant to the skin and intestines and is very apt to cause hemorrhage. The evacuation produced by it is at first watery and in larger doses bloody. Never more than one drop should be given. It may be given to unconscious patients by putting it on a piece of sugar and putting the sugar well back into the mouth when it is swallowed by reflex action. It may also be given mixed with four or

five drops of sweet oil. On account of its small bulk and the ease with which it can be handled it is frequently given to apoplectic patients.

COLOCYNTHIS derived from a plant indigenous to Japan is a powerful drastic, producing watery stools. ~~0.15~~ - .050

EXTRACTUM COLOCYNTHIDII. Dose 0.030-0.120. ~~0.30~~

ELATERINUM a very powerful hydragogue purgative used in the form of

TRITUATIO ELATERINI. Dose 0.030-~~0.080~~. 0.060

PODOPHYLLUM obtained from podophyllum peltatum or May apple or mandrake. It contains two active principles, podophyllotoxine and picro podophyllin. Both are isomeric and very toxic. It is not used in human beings on account of the griping it causes unless in combination with other drugs.

EXTRACTUM PODOPHYLLI. Dose 0.012-0.060.

EUONYMUS, or Wakoo, Spindle tree. Is a powerful cathartic.

EXTRACTUM EUONYMI. Dose 0.060-0.300.

CAMBOGIA, or gamboge, is a gum resin obtained from an Indian tree. Gripes somewhat and is never used alone, but always in combination with other drastics. Dose 0.030-0.300.

The official Compound Cathartic Pill, or pilulae catharticae, is composed of gamboge 0.015, calomel 0.060, jalap 0.030, colocynth, 0.080.

ANTHELMINTICS are drugs used to free the intestine of parasites. Some of them kill the worm, and the dead parasite is expelled with the faeces and are called vermicides; others simply narcotize it or drive it into the large intestine from which it is expelled by a purge; these are called vermifuges. Some affect the tapeworms while others affect the round worms. The drugs may be absorbed and cause poisonous symptoms, but they are only used for their local effect and not their systemic action. They may be divided into two groups according to the kind of worms they affect.

Drugs used for expelling the taeniae or common tape worms.

ASPIDIUM, male fern, or felix mas. The active principle is aspidine + felecic acid, a non-nitrogenous substance. Besides this it contains an oil. Dose ~~2.4-8~~ ¹⁰⁻³⁰, sometimes as much as thirty grams. The difference in doses is because it becomes inactive after a time. Never give with an oil as it may be absorbed and produce constitutional and sometimes fatal effects.

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OLEORESINA ASPIDII. Dose/4-4.

There is no means to tell whether the preparation is active or not except by trial

GRANATUM, or pomegranate, is the bark of the punica granatum. It contains different alkaloids of which pelletierine is supposed to be the active one.

PELLETIERINAE TANNAE. Dose 0.200-0.000. / 0.000

The tannate is not absorbed by the stomach. It is best given in water on an empty stomach. The two other forms in which it is used is the powdered root, Dose 2.000-6.000; and the decoction, Dose 32.-64. in 200 cc H₂O.

A purge of senna or jalap is always given after pelletierine.

CUSSO, or Koussou or Brayera, is a very good anthelmintic for tape-worms. The active principle is cosin or cussotoxine. The dose of the crude drug is 8.-15.-20. and less if a fresh drug is used than of an old preparation. Besides the crude drug the U. S. P. contains. (Broyers)

EXTRACTUM {CUSSO} FLUIDUM. Dose 4.-15.

The extract is more largely used than the crude drug. Some prefer to use it in the form of tablets each containing 1.000 of Cusso. One is taken every five or ten minutes until sufficient quantity has been taken. This is a very good way to give the drug.

PEPO or Pumpkin Seed. The active principle is unknown. It is a very good vermifuge. Dose 30.-90. The seeds must first be freed from the shell and macerated, then mixed with milk and taken upon an empty stomach. It must always be followed by a purge.

KAMALA or Rottlera is the glands and hairs from the capsules of mallotua philippinensis. The active principle is not known. Dose 5.-10. of the crude drug. For round worms especially ascaris, ~~lumbricoides is used, the following are used;~~

SANTONIUM or round worm seed is the flowering heads of Artemisia Pauciflora. Contains the active principle Santonin and also an oil. On account of the disagreeable taste of the oil it is very difficult to give to children and the best way is to give it in the form of

. 3 - 10

TROCHOSCI SANTONINI. Dose 1-6 for adults, one-half to ³one for children. The disadvantage is patient complains of seeing everything yellow, that is xanthopsia. Best given to children at bedtime followed by a purge in the morning.

SPIGELIA or Pink Root is the root and rhizome of Spigelia mari-

landica a plant of the U. S. The active principle is said to be a volatile alkaloid.

EXTRACTUM SPIGELAE FLUIDUM. Dose 1.000-8.000.

PULVIS SPIGELAE RADACIS. Dose ~~5.000-15.000.~~ up to 10g +

Used for all kinds of round worms. It must be followed by a purge.

CHENOPODIUM, or American worm seed. The active principle is not known, but some think it is an oil. Dose 0.100-0.600.

To obtain good results certain rules must be observed. 1. Evacuate the bowels two or three days before the cure is commenced with large watery stools. Have patient take only such food as will leave little residue, that is, abstaining from vegetables, fruit and milk. Give meats well spiced with pepper, also onions to drive parasite into the lower intestinal canal. 2. The next morning the patient is given the anthelmintic. 3. Five or six hours afterward give a dose of jalapa or senna. 4. The head of the parasite must be present; if it is not, the cure can only be repeated a few weeks afterward; that is, when parts of the parasite again appear in the faeces.

Don't give castor oil because it dissolves felix and will produce poisonous effects. It is insoluble in water. Physicians should examine faeces and see if head is present.

VEGETABLE BITTERS. The substances belonging to this group have a more or less bitter taste and are used extensively as stimulants to the gastric secretion. How they act is not known, it may be simply by a local stimulating effect. Of the hundred or more belonging to this group we will enumerate only thirteen as their action is similar and to know one is to know the action of all the others. We do not know that one is any better than another.

AUGUSTURA the bark of a South American tree is only used in bitters now as poisoning has occurred.

CALUMBA an East African plant. The fluid extracted only is used. Tinct. 4-5

EXTRACTUM CALUMBAE FLUIDUM. Dose 0.500-~~1.500.~~ 2. and

CALUMUS or Sweet Flag. Dose 1.000-4.000.

CHIRATA or CHIRATTA used in the form of

TINCTURA CHIRATA. Dose 2.000-8.000

EXTRACTUM CHIRATI FLUIDUM. Dose 0.300-1.000.

CINNICIFUGAE. U. S. P. contains two extracts and one tincture.

CONDURANGO the bark of a South American tree. It was once sup-

posed to be a cure for cancer and is often given in cancer but acts only as bitters. It has no more specific action than any of the other drugs.

CORNUS, or dog wood. The fluid extract is used. Dose 2.000.

COTO. The bark from a Bolivian tree.

GENTIANA. Gentian is used quite extensively.

EXTRACTUM GENTIANAE. Dose 0.100-~~0.500~~ 2.000

EXTRACTUM GENTIANAE FLUIDUM. / ~~1.000~~ 2.000.

TINCTURA GENTIANAE COMPOSITA. ~~2.000-8.000~~ 15.000

QUASSIA. From the wood of the *picraena excelsa*. Was used quite extensively thirty years ago; a cup was made from the wood and filled with water two hours before it was to be used. The water was then taken and the desired results produced.

EXTRACTUM QUASSIAE 0.050-0.200.

TINCTURA QUASSIAE 1.000-4.000.

LICHEN ICELANDICUS, or Iceland moss, contains a bitter principle and is more or less used for tubercular enteritis.

SERPENTARIA, or Virginia snakeroot.

EXTRACTUM SERPENTARIAE FLUIDUM. Dose 0.600-2.000.

TINCTURA SERPENTARIAE. Dose 2.000-8.000.

TARAXACUM, or dandelion. The extract is soluble in water and can be used in pill form. It makes a very good bitter.

EXTRACTUM TARAXACI. Dose 0.300-1.000.

EXTRACTUM TARAXACI FLUIDUM. Dose 4.000-12.000.

It is not known how they act, perhaps by some local action. They increase gastric secretion. The solid extracts are used for pill measure.

VEGETABLE ASTRINGENTS. Vegetable Astringents are organic substances containing tannic acid or its chemical relatives. They are used to harden the mucous membranes of the mouth, stomach, urethra, vagina, etc., and as a result less secretion is poured out.

If the membrane of the intestines is to be acted upon pure tannic acid is not used but some form that will not be acted upon in the stomach, and so reach the intestines unaltered. On the mucous membranes of the mouth, vagina or rectum pure tannic acid either dissolved in water or glycerine is used. Of all substances containing tannic acid only about nine will be given.

ACIDUM GALLICUM or Gallic Acid is a white crystalline powder, odorless, having an astringent taste, permanent in the air, soluble in 100 parts of water, 5 parts of alcohol and 12 parts of glycerine.

It is used internally, as it is supposed that the astringent effect is due to the fact that gallic acid is changed into tannic acid, but this has not been proven. It does not precipitate albumen, glue or alkaloids.

ACIDIUM TANNICUM, or tannic acid, very soluble in water, alcohol, and in eight parts of glycerine. Has a strong astringent taste. The official preparations are

COLLODIUM STYPTICUM, which contains tannic acid twenty parts, alcohol, ether and collodion.

TROCHISCI ACIDI TANNICI each contains about 0.060 of tannic acid. Dose ~~1-3~~ troches. up to 10.

UNGUENTUM ACIDI TANNIC contain 20% of tannic acid and the rest benzoated lard.

GLYCERITUM ACIDI TANNICI. 20% tannic acid, the rest glycerine.

Tannic acid in water or glycerine may be applied directly to the nose, mouth, vagina, rectum, and in case of ulceration of the rectum or large intestines a watery solution containing ten, fifteen, or twenty per cent. may be injected as an enema. For action upon the intestine it is best given in pill form coated with salol or some other substance not acted on in the stomach. Better still in the form of Tannigen which is not acted upon by the gastric juice but is split up in the intestines into acetic and tannic acid. The crude drug acts further down in the intestine.

TANNALBIN. A combination of tannic acid and albumen, containing 50% of tannin made by subjecting them to heat for five or six hours.

It is split up slowly into tannic acid and albumen in the intestine and its action will extend far down in the intestinal canal. Dose 1.000-4.000 repeated as often as necessary. It is an excellent preparation for mucous diarrhoea and mucous enteritis.

CATECHU, or Cutch, is an extract from an East Indian tree and contains a large amount of tannic acid. Dark red color, sweetish taste, insoluble in water.

TINCTURA CATECHU COMPOSITA. Dose 2.000-~~10~~⁵.000.

TROCHISCI CATECHU each containing 0.060. Dose 1 to 10 troches.

GALLA, or Nut Galls, an excrescence found on oak trees, inodorous and strongly astringent.

TINCTURA GALLAE. Dose 4.000-8.000.

UNGUENTUM GALLAE, consisting of nut gall and benzoated lard. Used externally.

KRAMERIA, or Rhatani, the root of an Bolivian tree. Official preparations are

EXTRACTUM KRAMERIAE. Dose 0.300-0.600.

TINCTURA KRAMERIAE. Dose 2.000-10.000.

TROCHISCI KRAMERIAE. Dose 1 to 5 troches.

KINO, inspissated juice of an East Indian tree.

TINCTURA KINO. Dose 2.-10.

HAMAMELIS, or Witch Hazel, contains tannic acid like the others of this group and is used for the same purposes.

EXTRACTUM HAMAMELIDIS FLUIDUM. Dose 2.000-8.000.

HAEMATOKYLON, or Logwood, the same as is used to stain microscopic specimens.

EXTRACTUM HAEMATOKYLI. Dose 0.300-1.000.

RUBUS, or Blackberry, the root bark of the Rubus.

EXTRACTUM RUBI FLUIDUM. Dose 2.000-8.000.

The preparations of tannic acid dissolved in water or glycerine are to be used locally on mucous membranes which can easily be reached. The pure drug is rarely used in cases when the effect is desired upon the intestine as it usually combines with albumins before it reaches it. In these cases the crude drugs are generally used as they contain colloid substances and so are not readily acted upon by the stomach but have their action mainly upon the intestine. For local action upon the intestine the best preparation to use is Tannalbin. The objection to it is its cost.

DISINFECTANTS of the GENITO-URINARY TRACT. The substances belonging to this group are used either to disinfect or for their diuretic effects upon the genito-urinary tract. They are all organic compounds. Whether their diuretic effects are produced by their influence on Bowman's capsule is not known. The decomposition products are, as a rule, glycuronic acid. The increase in urine is due to their local irritant effect. The urine is also kept from decomposing and rendered to some extent antiseptic by their presence. Most all of the members of this group possess both properties.

BUCHU. The leaves of an African plant containing a volatile oil.

EXTRACTUM BUCHU FLUIDUM. Dose 1.000-~~3.000~~. 2. ~

It is used as diuretic and urinary disinfectant, giving the urine a strong characteristic odor.

OLEUM JUNIPERI, or Oil of Juniper, is a volatile oil derived from the juniper berries.

SPIRITUS JUNIPERI. Dose 2.000-4.000.

SPIRITUS JUNIPERI COMPOSITUS. Dose 4.000-15.000.

COPAIBA, or Balsam of Capaiba, is an oleo resinous exudation of a Brazilian tree, oily and transparent. Dose 1.000-~~4.000~~. 6.000

OLEUM COPAIBAE is the oil freed from the resin by distillation. Dose 0.500-1.000.

RESINA COPAIBAE is the residue left after distillation. Dose 0.300-1.000.

Of the three preparations, the balsam itself is mainly used to disinfect the genito-urinary tract. The resin is used as a diuretic in dropsy due to heart and liver diseases. It irritates the kidney and should never be given in kidney diseases. It is also sometimes used in foetid bronchitis.

CUBEBA is the unripe fruit of Piper Cubeba. The official preparations are

OLEO RESINA CUBEBAE. Dose 0.300-2.000.

EXTRACTUM CUBEBAE FLUIDUM. Dose 2.000-4.000.

TINCTURA CUBEBAE. Dose 2.000-~~10.000~~. 15.000

PULVIS CUBEBAE. Dose 2.000-4.000.

Cubeba is used for the same purposes as Copaiba. It is also used to disinfect the respiratory passages in the form of cigarettes the smoke of which is inhaled, but the action is only slight as it cannot reach very far down. Like all volatile oils it acts as a skin irritant which must be remembered as an eruption may follow the smoking of one or two cigarettes.

OLEUM SANTALI or Sandalwood oil a pale yellowish, thick liquid, strong aromatic odor and a pungent spicy taste. Readily soluble in alcohol. Mostly used in gonorrhoea to disinfect the urinary tract. Dose 0.100-0.600 in a gelatine capsule three to six times per day.

UVA URSI, or bear berry, contains different glucosites. Has a strongly astringent and somewhat bitter taste.

EXTRACTUM UVA URSI. Dose 0.300-1.000.

EXTRACTUM UVA URSI FLUIDUM. Dose 1.000-4.000.

Simply given as a diuretic and disinfectant of the genito-urinary tract. Many other substances are given for these purposes but the above are sufficient for all practical purposes.

✓ FLAVORING AGENTS. This group of substances are used as flavoring agents, either to disguise bad tasting substances or to give flavor to tasteless ones, so that the patient will take the medicine prescribed more readily.

The one used in the majority of cases is SACCHARUM, or cane sugar. The official

SYRUPUS is a watery solution containing eighty per cent of sugar.

SACCHARIN, an artificial product, is used in place of cane sugar when, for any reason, the patient cannot take the latter as in diabetes. It is 300 times sweeter than cane sugar.

THERIACA or Treacle or Molasses is a residue from the sugar refineries.

ROSA GALLICA or Red Roses. Prepared from this is CONFECTIO ROSAE consisting of rose water, red roses, sugar and honey.

UNGUENTUM AQUAE ROSAE, or Cold Cream, is formed of spermaceti, white wax, oil of almonds and borax, scented with rose water.

OLEUM ROSAE used in strong and weak watery solutions as flavoring agents.

RUBUS IDAEUS, or raspberry, is used in the form of SYRUPUS RUBI IDAEI, to flavor or color only acids and not alkaline solutions.

MELISSA, leaves and tops of *Melissa officinalis*.

VANILLA. The official preparation is

TINCTURE VANILLAE.

SUCCUS MORI, or Mulberry juice.

CROCUS is used simply as a coloring agent.

These have no physiological action and are used simply to make the medicine more pleasant or agreeable so that it will be more readily taken by the patient.

VEHICLES. These are substances used to convey the active principle into the intestinal canal and consists of colloid substances. When drugs are mixed with these they are readily conveyed into the intestines. If drugs are wished to act in the stomach they should be put in watery solutions. The members of this group have no medicinal properties and are only used as vehicles for drugs whose action is desired upon the intestines. / *tablespoonful*.

ACACIA or Gum Arabic.

MUCILAGO ACACIAE contains 84% Acacia.

CHONDRUS or Irish Moss contains 90% of mucilaginous substances.

ALTHAEA or Marshmallow.

TRAGACANTHA is a resinous exudation.

ULMUS or Slippery Elm grows in North America.

The official preparations of all the above except Chondrus is the mucilage (*Mucilago*).

SUBSTANCES used on account of their MECHANICAL ACTION.

CARBO AMIMALIS or bone black.

CARBO LIGNI, or purified wood charcoal.

Freshly prepared dry charcoal absorbs gases and vapors and may be useful in sick rooms to absorb bad odors. Internally it is given as an absorbent of gases, but is not used now as much as formerly because as soon as it becomes wet it loses its absorptive power. It is best given in the form of lozenges or tablets of animal charcoal, and as many may be given as the patient will take. Animal charcoal also will absorb coloring matters and on this account is used in filtering drinking water, and in chemical laboratories to decolorize solutions.

GOSSYPIUM, or absorbent cotton, is cotton from which the fat has been removed with ether. Mainly used in surgical dressings. When treated with sulphuric and nitric acid it is transformed into

PYROXYLIN, or gun cotton, which, when dissolved in ether and alcohol forms collodion.

The U. S. P. contains

COLLODIUM, or ordinary collodion.

COLLODIUM FLEXILE. Made by adding turpentine and castor oil to the ordinary collodion.

Collodion is used externally as a protective and sometimes to bring active drugs into contact with the skin. The following preparations are instances of this sort.

COLLODIUM STYPTICUM, containing tannic acid,

COLLODIUM CANTHARIDATUM, or blistering collodion, which contains cantharides.

If collodion is painted on the skin it evaporates rapidly and leaves a thin protective film which exercises a uniform pressure upon the surface. On account of its adhesive action it is used to bring small wounds in apposition and stop small hemorrhages. It is sometimes used on sore nipples to protect them from air and prevent infection.

ELASTICA is prepared from the milky juice of a Brazilian tree. Used only for surgical elastic bandages and bougies.

GUTTA PERCHA is the milky exudation of a Brazilian tree and used for the same purposes as elastica. Official preparation is

LIQUOR GUTTA PERCHA. A preparation of gutta percha, chloroform and lead carbonate and sometimes called Traumaticin, is used for the same purposes as collodion.

LYCOPodium, or vegetable sulphur. It is used mainly as a dusting powder.

ICHTHYOCOLLA, or isinglass, is the swimming bladder of acipenser. Contains about ninety per cent. of mucilaginous substances, which, when boiled with water, forms a solution, and on cooling a transparent jelly. It is used in the form of

EMPLASTRUM ICHTHYOCOLLAE, or court plaster, is silk, one side of which has been coated with a mixture of isinglass, alcohol and water and the other side with tincture of benzoin.

ANIMAL DERIVATIVES. FEL BOVIS, Fel Tauri, or Ox Gall, is always used in the form of

FEL BOVIS PURIFICATUM. Dose ~~0.300-2.000~~ 0.500 up to 4 or 5.

Is used as a purgative and cholagogue and is best given in pill form coated with salol.

By cholagogue is understood a drug which increases the secretion of bile. There is found in the different text books a long list of cholagogues, but there is only one drug which acts in this way, and that is BILE itself. There is not only an increase of the fluid of the bile excreted, but also an increase in the biliary acids.

Ferments.

PEPSINUM is prepared from the stomach of pigs. The preparation should be of sufficient strength to digest not less than 3,000 times its own weight of fresh egg albumen.

PEPSINUM SACCHARATUM contains 10% of pepsin and 90% of sugar. Many preparations on the market are practically inert, digesting only ten or twenty times its own weight of freshly coagulated albumin. If indications are present that pepsin is lacking, it should be given in doses of from teaspoonful to tablespoonful to be of any value. In 95% of the cases in which it is given, it is not needed and is only called for in cases of complete atrophy of the stomach. Whenever free hydrochloric acid is present there is always sufficient pepsin also.

PANCREATINUM, obtained from the fresh pancreas of the pig. A good preparation should be able to change starch into sugar in acid and alkaline media, and digest albumin. Only a fresh preparation will do this; Pancreatin is digested in the stomach and in order to reach the intestines should be given in pill form and coated with some colloid substance. Bicarbonate of soda should be given with it as it acts better in alkaline medium. If pancreatin is given it should be in doses of teaspoonful at least the same as

with pepsin. Not derived from the animal kingdom but used for the same purpose as pepsin and pancreatin is

PAPAIN, or Papoid, a ferment derived from carica papaya. It digests proteids in alkaline, acid and neutral media. It is used sometimes to digest croupous and diphtheretic membranes by local application. The dose of papain depends upon the activity of the preparation.

THYROIDINE is extracted from the thyroid gland and contains iodine derivatives. It seems that thyroidine is the active principle of the thyroid gland which enters the blood by the so-called internal secretion. In cases where the thyroid is removed or where it is absent, as in myxoedema, there is a series of complex symptoms which are entirely relieved by the administration of this preparation.

In spite of its almost specific action in these cases there is no official preparation. The preparation of the different manufacturers vary in strength. The best one to use is that of Park, Davis & Co., which comes in tablet form, each tablet containing 0.120 and corresponds to 0.300 of the gland. In the beginning it should be given in small quantities never more than one tablet per day at first and gradually increasing up to three per day. During its administration the patient should be kept in bed, as intense headache and heart failure may result. It may be used with very good results in cases of excessive obesity, reducing the weight several pounds per month without any limitation of the diet. How this action is produced is not known. Murry, an English physician, was the first to use this gland internally. Previous to this the gland was grafted into the system, but after a time became absorbed.

THYMUS. The extract of this gland is used especially in goitre but the results are not at all striking.

SUPRA RENAL, or Adrenal Gland. The physiological action of this substance consists in the rise of blood pressure which rises after the administration of this extract more than with any substance studied. This rise is due to constriction of the arterial system and to the direct effect on the vaso motor centre. The active principle seems to be of an alkaloidal nature, but has not as yet been obtained sufficiently pure to classify it definitely. As to its use in practical medicine, opinions are widely divided. Until now it has only been used in neurasthenia, and by oculists locally, to contract the vessels of the conjunctiva when congested.

TESTICULAR EXTRACT was supposed to contain substances which increased the general tone of the system, but as we do not know what tone is, we do not know what the action is. It was first brought to notice about fifteen years ago by Brown-Sequard, a professor here at that time and on account of his professional standing was used quite extensively for some time. It was supposed to be of great use especially in old men to add tone to the system, and to the sexual organs especially.

Other extracts of animal origin whose value is not known at all are extracts of bone marrow, and besides this, in the past year or so, extracts of brain, heart, muscle and in fact of nearly all organs. These extracts have some action but as yet we do not know how to use them.

ANTITOXINES. In the treatment of diphtheria antitoxin has been used for the past few years with very great success. The mode of preparation is as follows:

Bacteria when introduced into suitable surroundings produce as a result of their action certain substances which are very poisonous and are known as Toxines. When these substances are introduced into the body either directly or as a result of the action of bacteria introduced, the organism produces certain other substances which neutralize these poisonous products and are known as Antitoxines.

Certain animals are not very susceptible to certain diseases and yet at the same time produce large amounts of antitoxin. Advantage is taken in the preparation of diphtheretic antitoxine of the lessened susceptibility of the horse. They are inoculated at first with only small amounts of the filtered toxine of the Klebs-Loeffler Bacilli and this is gradually increased as their susceptibility becomes lessened until they are immune or practically so to large doses. A certain amount of their blood is now withdrawn and the serum separated from it. This contains products which are found to neutralize the toxines produced by the bacilli and is the antitoxine now used in the treatment of diphtheria. The antitoxic power of the serum varies more or less with each blood letting, so before it is sent out it is very carefully tested in this respect and with each specimen sent out there is also the statement of its strength ;therefore the size of the dose will vary according to the strength of the serum and cannot definitely be given.

As to the bad effects produced by the antitoxine of diphtheria, see the paper prepared last year by Doctor McCollom, Superintendent South Department, B. C. H.

There is also an Antitoxine prepared from the tetanus bacillus but as yet there is not sufficient data to warrant forming a decided opinion as to its value.

The Streptococcus Antitoxine has been used to quite an extent in septicaemia, puerperal fever and infectious endocarditis, but the clinical results have not been as satisfactory as was hoped.

OXYGEN GROUP. The members of this group readily lend oxygen to animal tissues and because of this action are so classified. They are as follows:

1. Oxygen and its allotrophic form Ozone.
2. Hydrogen Peroxide, an unstable compound.
3. Potassii Permanganas, reddish brown crystalline substance, soluble in sixteen parts of water. Stable when dry but yields up oxygen when moist.
4. Acidum Chromicum, crystalline, soluble in ten parts water.
5. Potassii Bichromas, soluble in ten parts of water.
6. Potassii Chloras, soluble in twenty parts of water, does not yield oxygen as readily as the others and only when dry.

Until lately these substances have been used more or less with the idea that when taken internally they would increase the oxygen in the system upon being decomposed in the intestine. They are broken up in the intestine and the oxygen liberated may act as a caustic and if strong enough cause necrosis, but the amount in the system is not increased as it is not taken up by the blood.

Oxygen is one of the gases that does not fall under the law of partial tension, the amount of it absorbed depending upon the amount of haemoglobin in the blood alone. The red corpuscles will take up only so much, and no matter how much additional there is in the lungs or in the intestine, no more will be absorbed after their affinity is satisfied. Under ordinary circumstances there is enough oxygen in the air to oxidize all the haemoglobin in the blood and an additional supply is of no use as no matter how strong the proportion of oxygen in the air only a certain definite amount will be taken up.

In cases where the aerating surface of the lung is lessened from any cause as in pneumonia, inhalation of oxygen gas may be of great benefit as under the circumstances the normal amount of air cannot enter the lung and there will be a deficiency of oxygen

which inhalations of the prepared oxygen will relieve. To overcome this deficiency under ordinary circumstances the lungs have to expand oftener and this is the cause for the increased respirations found in pneumonia and phthisis.

Oxygen acts beneficially in pneumonia only by reducing the dyspnoea and thus giving the patient a much needed relief. For administration in these cases it comes specially prepared in metal cylinders which are provided with a tube and shut-off valve so that the escape can be regulated. The cylinder should be connected with a glass flask partly filled with water, and having fitted into its neck a stopper containing two glass tubes one ending beneath the surface of the water and one above it. A tube passes from the one ending above the water to the patient's mouth, while the cylinder is connected with the other. The gas escaping from the cylinder bubbles up through the water and passes through the other tube to the patient, the amount of bubbling showing you the amount of oxygen escaping from the cylinder and may be regulated by the stop cock according to the amount needed.

HYDROGEN PEROXIDE is used only as a disinfectant for suppurating cavities, etc. If injected into the cavity there must be an outlet for it in order that its irritating effect may be avoided.

PERMANGANATE of POTASSIUM is used as a disinfectant in gonorrhoea, leucorrhoea, etc. It is also used by surgeons to disinfect their hands. It can be used only locally as it yields its oxygen very easily. Its action is only superficial and is used only in accessible cavities as nose, urethra, vagina, rectum, etc.

CHROMIC ACID is used as a caustic and disinfectant in genito-urinary diseases, etc.

BICHROMATE of POTASSIUM has the same properties as the above and is used in the same class of cases. Lately it has been used by some physicians internally in gastric ulcers with a view of acting as a caustic on the ulcerative surfaces. It acts the same way as silver nitrate forming a coat over the surface. Dose 0.005-0.010.

CHLORATE of POTASSIUM is used in inflammation of the mouth and tonsils and irritable conditions of the mouth and throat. It is best used in a diluted watery solution. How it acts is not definitely known.

Taken internally it is excreted with the urine practically unchanged and in large quantities may cause not only irritation of the kidneys but even Acute Nephritis. It is also excreted to

some extent in the saliva. After absorption into the blood it may cause destruction of the red globules with a resultant hemoglobinuria. Like all potassium salts it acts as a depressant to the heart after absorption.

As it is insoluble in less than twenty parts of water, 5% is the strongest solution which can be made, therefore do not call for a 15 or 20% watery solution. The U. S. P. contains an official troche, each containing 0.300, but their use internally is not rational as the potassium only is excreted in the saliva. For mouth and pharangeal troubles it is used to the best advantage in watery solutions as a gargle or mouth wash.

CHLORINE GROUP. Belonging to this group are three halogens and all drugs which when decomposed in the system liberate free halogens.

AQUA CHLORI. An aqueous solution of chlorine gas containing 0.4% of the gas. Dose 4.000-16.000 well diluted.

CALX CHLORATA. Chloride of Lime is a whitish gray powder and should have at least 35% of available chlorine.

LIQUOR SODAE CHLORATAE is a pale greenish liquid and should contain at least 2.6% of available chlorine.

BROMUM, or Bromine, is a dark brownish-red liquid, soluble in thirty parts of water, readily soluble in alcohol and ether.

IODUM, or Iodine. Bluish-black rhombic plates, soluble in 5000 parts of water and ten parts of alcohol, also freely soluble in watery solutions of sodium chloride and potassium iodide. The official preparations of Iodine are

LIQUOR IODI COMPOSITUS (Lugol's solution) contains 5% of iodine and 10% of potassium iodine. Dose 0.060-0.600.

TINCTURA IODI contains seven per cent. of iodine.

UNGUENTUM IODI contains four per cent. of iodine, one per cent. of potassium iodide, water two per cent. and benzoinated lard ninety-three per cent.

ACIDUM IODICUM could also be included in this group, but as it is not used in medicine it can be disposed of without further mention.

Chlorine has a strong affinity for metals. Organic compounds are very readily affected by chlorine, not so easily by bromine or iodine. All the halogens form either addition or substitution products with other compounds.

Chlorine first coagulates proteids and later destroys them.

Iodine forms an albuminate. Bromine has an affinity midway between chlorine and iodine. This special property of the halogens and their destructive powers on organic material makes them useful as deodorizers, antiseptics and antizymotics. They may also be used as irritants, astringents or caustics, according to their strength. They are excellent disinfectants where ammonium and hydrogen sulphide are present on account of their great affinity for hydrogen. To disinfect rooms or other bad smelling places ten to twenty grams of the chloride of lime (bleaching powder) is put on a plate and placed in the room which it is desired to disinfect.

Internally chlorine is used as a mouth wash and gargle to disinfect and stimulate foul ulcers of the mouth and throat and especially in diphtheria. The vapor of chlorine when inhaled causes great irritation and pain of the respiratory passages, cough, sneezing and lacrymation.

On account of the low boiling point of chlorine it cannot be used easily, and as bromine is much more stable it is much easier to use. Iodine is much used in the form of the tincture and the iodide of potassium.

In concentrated forms as caustics they will not only destroy the skin and hair but also the underlying tissues, and because of this action, chlorine dissolved in bromide, which makes a very powerful caustic, is often used to remove new growths especially in those cases where the removal of cancer without the knife is advertised.

On account of the local irritant effect of iodine, a watery solution is often injected into a hydrocele after tapping in order to produce local irritation with the hope of forming adhesion and thus obliterating the cavity.

The first symptoms of poisoning are coughing, later followed by dizziness, nausea and perhaps unconsciousness, this latter being due to the narcotic effect which all the halogens have.

Treatment of poisoning. As soon as the first symptoms are noticed, the patient should be put in a room containing steam and made to inhale as deeply as possible. Iodine in toxic doses always causes vomiting as it is excreted into the stomach.

SULPHURIC ACID GROUP. The members of this group are characterized by their great affinity for the electro-positive elements of the body. Their specific action are only obtainable when they are

present as free acids. Belonging to this group are all the mineral acids and some of the organic acids. The acids and their official preparations are as follows:

ACIDUM SULPHURICUM. Oil of Vitriol is a liquid composed of 92% by weight of absolute sulphuric acid, the rest water. In concentrated form it is used only locally.

ACIDUM SULPHURICUM DILUTUM contains 10% by weight of absolute sulphuric acid. Dose 0.600-2.000.

ACIDUM SULPHURICUM AROMATICUM is an alcoholic solution flavored with Oil of Cinnamon and contains about 20% of sulphuric acid. Dose 0.300-1.000.

ACIDUM NITRICUM has sixty-eight per cent. of absolute nitric acid and thirty-two per cent. of water, and is a colorless fuming liquid.

ACIDUM NITRICUM DILUTUM contains ten per cent. by weight of nitric acid. Dose 0.700-2.000.

ACIDUM NITRO-HYDROCHLORICUM DILUTUM contains only 0.4 per cent. of nitric acid and 1.8 per cent. of hydrochloric acid. Dose 0.700-2.000.

ACIDUM HYDROCHLORICUM is a watery solution containing thirty-two per cent. by weight of absolute hydrochloric acid.

ACIDUM HYDROCHLORICUM DILUTUM is composed of hydrochloric one part, water two parts. Dose 0.300-2.000.

ACIDUM PHOSPHORICUM is a liquid composed of not less than eighty-five per cent. orthophosphoric acid by weight.

ACIDUM PHOSPHORICUM DILUTUM contains ten per cent. by weight of orthophosphoric acid. Dose 0.300-2.000.

ACIDUM ACETICUM contains thirty-six per cent. by weight of absolute acetic acid.

ACIDUM ACETICUM DILUTUM is a watery solution containing six per cent. acetic acid. Dose 4.-15.000.

ACIDUM ACETICUM GLACIALE ought to contain not less than ninety-nine per cent acetic acid. It is a nearly colorless liquid and is used only locally.

TRICHLOR ACETIC ACID is not official. Consists of deliquescent crystals soluble in water, alcohol and ether. Used only by surgeons.

ACIDUM FORMICUM, liquid containing about 25% free formic acid.

ACIDUM CITRICUM, colorless crystals readily soluble in water. Dose 0.300-2.000.

SYRUPUS ACIDI CITRICI. Dose 4.-15.

Xanthoprotein acid

ACIDUM TARTARICUM, readily soluble in water and in two and a half parts of alcohol. Dose 0.300-2.000.

ACIDUM LACTICUM, a colorless syrup readily miscible with water, alcohol or ether. Dose 0.600-2.000.

~~ACIDUM FORMICUM, liquid containing about 25% free formic acid.~~

ACIDUM BORICUM, crystals soluble in twenty-five parts of cold water, ten parts of glycerine and fifteen parts of alcohol. Dose 0.300-2.000. (470 ml)

GLYCERITUM BOROGLYCERINI or Glycerite of Boric Acid is a liquid consisting of 30 per cent Boric acid and 70 per cent Glycerine.

SODII BORAS or Borax is a white powder soluble in ten parts of water. Dose 0.300-2.000.

The effect of a concentrated acid will be principally a local caustic one, stronger on mucous membranes, less marked on the skin. There will be only slight if any systemic effect, as absorption of concentrated acids as a rule is not possible on account of its powerful local action, causing a destruction of the tissues. In diluted forms their action is not so marked, instead of it being a caustic it will simply be that of an astringent, following the rule that caustics when well diluted act only as astringents.

Acids have a great affinity for water and absorb it whenever possible. In the body this may take place in two ways,

1. By taking up the free water in the tissues.
2. By taking away the hydrogen and oxygen of the tissue itself thus destroying it. Therefore the action of an acid will depend first, upon its strength; second, upon the amount of free water in the tissues.

In diluted forms they will act as astringents, in stronger solutions as irritants and in concentrated form as caustics. The action of acids upon proteids depends upon whether

1. The acid is diluted or concentrated.
2. The albumen is in concentrated form or in solution. If the acid is diluted and the albumin is in solution, an acid albumin will be formed. If the acid is concentrated the albumin will be precipitated. Acids in concentrated form are used as CAUSTICS in syphilitic sores, cancers, erosions of the cervix, etc. *com*

ANTISEPTIC effects are not marked in the strength in which they can be used without producing local effects. Boric acid is but slightly antiseptic, although it is used a great deal for this purpose.

If concentrated acids are swallowed their effect is seen everywhere they touch. The mouth, pharynx, oesophagus and stomach are

powerfully irritated, the tissue being destroyed in places, sometimes to such an extent that perforation is produced. Their action is, of course, more marked in the stomach as it is more prolonged here than in the mouth and oesophagus. The cause of death in these cases is either an acute gastro enteritis or perforation. They stain the lips and skin whenever they come in contact with them, and this may help in the diagnosis of the acid taken. The stain produced by nitric acid is yellow; by hydrochloric, brownish gray; by sulphuric, black.

In cases of poisoning use magnesium or soap as an antidote. Do not use calcium compounds as carbonic acid gas will be liberated and tend to produce perforation if ulcers are present in the stomach.

Diluted, they act upon the skin and mucous membranes as local irritants. In the mouth they cause an increase in the flow of saliva. In fevers, when the skin is dry and hot, sponging it over with water to which a little acid has been added will often cause sweating, due to the local irritation, thus cooling the patient and making him feel more comfortable.

In unconsciousness from asphyxia the vapor of nitro and hydrochloric acid may be used as their local action causes increased reflex action, and so an increased respiration is produced.

For local action upon the mouth only the organic acids should be used as the mineral acids produce caries of the teeth, and in cases where the latter are ordered they should be taken through a glass tube in order to avoid this. Any of them, if used too long, may be the cause of gastric irritation, and if continued, gastritis.

Hydrochloric acid is frequently given with good results where there is a deficiency of it in the gastric secretion.

Concentrated acids are absorbed neither from the stomach nor the skin on account of the local distinctions of the tissues, but if given in dilute form are absorbed.

After absorption, in case of organic acids, they are, to a large extent, oxidized and leave the system as carbonates in the urine, but always as salts. To render the urine alkaline the acid salts are used.

After the absorption of acids into the blood the blood becomes reduced in alkalinity whether the acid taken be mineral or organic.

HCl finer, may act as strong diuretic.

In rabbits the alkalinity of the blood may be reduced from twenty-six volume per cent. to about two volume per cent., but the blood can never be made acid in reaction, as the animal will die before this is produced on account of blood pressure and paralysis of the centre of respiration. The injection of sodium bicarbonate, even in the last stages of acid poisoning is followed by rapid recovery due to the increased alkalinity of the blood.

In carnivora and man the absorption of acids will reduce the alkalinity of the blood, but not nearly to the same extent as in rabbits, but no bad effects will be seen from it, as the reduction will be only from twenty-six to about twenty volume per cent.

Under what conditions the use of acids to decrease the alkalinity of the blood may be useful, is not known at present, but as our knowledge advances there may be diseases found in which the condition is due to an excess of alkalinity, the same as it is now thought that the cause of diabetic coma is the presence of excess of acid in the blood.

ALKALI GROUP. Belonging to this group are all those substances whose action depends upon their basic power to neutralize acids.

Excluded from it are Ammonia and all organic bases which have a special action. Belonging mainly to this group are the Oxides and Hydroxides of Calcium, Magnesium, Sodium and Potassium and some salts of strong bases with weak acids which act as strong alkalies or are decomposed upon absorption and then act as alkalies, such as Carbonate of Sodium, Potassium, Lithium, Calcium and Magnesium, basic Phosphate of Calcium and some salts of fatty acids, the so called soaps mainly.

POTASSIUM GROUP. POTASSIUM, Potassa Hydras, Caustic Potash, dry white solid, readily soluble in water. *30 pts*

LIQUOR POTASSAE contains 5% Potassium Hydrate. Dose 0.300-2.000 well diluted. *very*

POTASSA cum CALCE, Vienna Paste, grayish white, deliquescent powder. *= pts K + C.*

POTASSII CARBONAS soluble in 1 part of water. Dose ~~1.3~~ 2.0.

POTASSII BICARBONAS soluble in 5 parts of water. Dose 1.6-4.0.

POTASSII ACETAS very soluble in water. Dose 0.3-4.0.

POTASSII CITRAS very soluble in water. Dose ~~0.6-4.0~~ .4-2.

POTASSII CITRAS EFFERVESCENS. Dose ~~1.2-8.0~~ .5 - 4

II. SODIUM GROUP. SODIUM, Hydrate of Sodium, freely soluble in water.

LIQUOR SODAE contains five per cent Sodium Hydrate. Dose 0.3-2.0.

SODII CARBONAS (washing soda), colorless crystals. Dose 0.3-2.0.

SODII BICARBONAS (baking soda), soluble in twelve parts water. Dose ~~0.3-4.0.~~ .3 - 4.

SODII ACETAS crystalline powder soluble in two parts of water. Dose ~~0.3-4.0.~~ .3 - 4.

III. CALCIUM GROUP. CRETA PREPARATA, or prepared chalk is a white amorphous powder, insoluble in water. Dose 0.3-4.0. Preparations of this are

PULVIS CRETAE COMPOSITUS. Dose 0.3-4.0.

MISTURA CRETAE, composed of compound chalk powder, cinnamon water and water. Dose ~~up to 12.~~ 8 - 20

TROCHISCI CRETAE each containing one fourth gram of prepared chalk.

CALCII CARBONAS PRECIPITATUS a fine white powder, insoluble in water. .3 - 4

CALX Calcium oxide or burned lime. Hard white masses soluble in 750 parts of water. Preparations of this are

LIQUOR CALCIS, lime water. Solution containing about 0.2% of lime. 5 - 30

LINIMENTUM CALCIS or Carron Oil is composed of equal parts of lime water and linseed oil.

CALCII PHOSPHAS, a white amorphous powder, odorless and tasteless, permanent in air. Dose 0.3-20.

Syrupus Calcium phosphatis 4 - 10

IV. MAGNESIUM GROUP. Magnesia, magnesium oxide, light magnesia, calcined magnesia, a very light white powder almost insoluble in alcohol and water. Dose 0.3-4.0.

MAGNESII CARBONAS. Almost insoluble in alcohol and water. *White powder.* Dose 0.3-4.0.

V. LITHIUM GROUP. LITHII CARBONAS, a white powder permanent in air and soluble in about eighty parts of water.

LITHII CITRAS, deliquescent white powder soluble in two parts of water. Dose up to 2.0

LITHII CITRAS EFFERVESCENS, soluble in water. Dose 4.-16. 10 - 20

The members of the alkali group have a local action the same as those of the acid group. In concentrated solutions they act as caustics, in more dilute form as local irritants.

Their caustic effect is due partly to their power to absorb water and partly to their direct action upon the tissues. In concentrated solutions they penetrate deeply into the skin and form and ulcers. In more dilute form the caustic effect does not destroy the tissues but softens and dissolves them forming alkali albuminates.

The strongest caustics of the group are the hydrates of sodium and potassium and the oxide of calcium. The carbonates of sodium and potassium also act as caustics but not near so powerfully. For use as a powerful caustic potassium hydrate is mainly used but as it is deliquescent its action is not definitely localized, but somewhat diffuse. To obviate this it is generally used mixed with calcium oxide which is permanent, under the name of Potassa cum Calce or Vienna paste.

Weaker solutions of calcium and sodium are sometimes used in hydrocele to produce inflammation and adhesions of the tunica vaginalis. They are also used in lotions to prevent itching, their local irritant action causing more blood to come to the surface thus relieving the itching.

Alkalies are used in soaps on account of their action upon the epidermis, softening the skin and dissolving the dirt, thus assisting materially in its removal.

Lime water acts partially as an astringent and somewhat as a protective covering, and on this account is very largely used upon burns and cracked nipples. In the form of carron oil it is especially valuable in burns.

Weaker solutions of those elements are used in those conditions when the secretion of mucus is sticky and tenacious such as chronic catarrh where they act upon the mucus making it less dense and tenacious and thus more easily expelled. In the weaker forms the alkalies are used to lessen the acidity of the stomach, but their constant use is injurious to digestion and should be avoided.

Poisoning sometimes occurs from the injection of members of this group; the symptoms being those of a severe gastro-enteritis. Perforation more often occurs in these cases than with acids due to the softening and more diffuse action of the alkalies upon the stomach membranes. As an antidote use some dilute organic acid preferably; if not present a very dilute mineral acid may be used.

In conditions where carbonic acid gas is present in the stomach or intestine magnesia or magnesium carbonate (this latter being transformed into the acid carbonate) is very useful in absorbing

and removing it. The quickness of the absorption will depend upon the preparation used. The acid carbonates are very slowly absorbed and rapidly excreted, so that at no time is there a very great amount circulating in the blood. In large quantities most of the salts will act as aperients.

Potassium salts act as depressants to the heart but when they are taken by the mouth this effect is not seen as they are rapidly excreted by the kidneys so that there is very little circulation in the blood at any one time.

Calcium and Magnesia are readily absorbed by herbivorous animals and are excreted by them in the urine differing in this respect from carnivorous animals and man in which they are principally excreted with the faeces and only to a slight extent in the urine, as after their absorption they are largely excreted by the epithelium of the intestines. Neither are retained in the system in any large quantities. By feeding herbivorous animals foods containing large amounts of calcium the amount circulating in the blood will be increased but this is true to only a very limited extent in man and carnivorous animals on account of its excretion in the faeces.

The effect of the absorption of alkali is to increase the alkalinity of the blood. The acetates and tartrates are more rapidly absorbed than the carbonates thus rendering the blood more alkaline and in consequence of this the salts of the organic acids are to be preferred when it is desired to increase the alkalinity of the blood. How does the alkalinity of the blood effect the metabolism? Formerly thought and generally assumed the richer the blood in alkaline substances the easier the oxidizing process in the system. It has been given in cases of diabetes to increase the oxidizing process so that the sugar may be transformed into carbon dioxide and water. This treatment has however been abandoned. In gout it is still used. It is not known whether they increase the oxidizing processes in the normal condition and still less is known of their action in pathological conditions.

Experiment on animals and man with the intention of affecting the general metabolism give entirely different results with different men. Some say they increase the urea and others deny it. Some claim it increases the blood corpuscles and this is contradicted by others.

Scurvy. The pathology of the disease is not well known. It is not known whether the symptoms and signs are due to the lack of potassium salts in the blood or decrease of its alkalinity but it

is known that acetate of potassium or simple organic salts in the form of fresh vegetables or fruit relieve this condition.

Alkalies are frequently given to dissolve the uric acid as the alkaline salts of uric acid are more soluble than the acid itself. Large stones are scarcely affected by it and if the alkaline treatment is continued for a long time there may be even a growth of the stone due to the deposition of earthy phosphates. Those alkalies which are excreted by the kidney act as diuretics and are especially useful in all dropsical conditions due to lessened activity. How they act is not known except that it is not by an increase of blood pressure. Alkalies are also made use of to reduce the acidity of the urine where it contains an excess of acid. In acute cystitis and parenchymatous nephritis the alkaline treatment is sometimes used to dissolve the fibrin, which is found in these conditions.

SULPHUR GROUP. Belonging to this group are the following official preparations,

SULPHUR in its three forms,

SULPHUR SUBLIMATUM or sublimed sulphur or flowers of sulphur is a fine powder with a faintly acid taste.

SULPHUR PRECIPTATUM or milk of sulphur more finely divided than sublimed and without taste or odor.

SULPHUR LOTUM or washed sulphur is prepared by washing sublimed sulphur with water and ammonia. All of the above are insoluble in water and dose for each is from 1.000-4.000.

UNGUENTUM SULPHURIS consists of sulphur 30 per cent., benzoinated tãrd 70 per cent.

POTASSA SULPHURATA or liver of sulphur. Soluble in two parts of water.

CALX SULPHURATA or sulphate of lime contains 60 per cent. of calcium sulphite and 40 per cent. impurities. Dose ~~0.000-0.050~~.

SULPHURIS IODIDUM. Grayish-black powder with an odor of .01 - .03 iodine. Dose 0.060-0.300. - 6

Sulphur itself is not soluble in the different liquids of the body, but in contact with fats forms sulphuretted hydrogen, and this latter acts as a local irritant. It is used as a local irritant in those cases where a mild stimulant is desired, and for this purpose the ointment is used in ulcers and chronic rheumatism. Sulphuretted hydrogen is very poisonous. This effect is most noticeable on the lower animals and parasites, and on this account is is used in scabies.

Sulphur, in the form of ointments and lotions, is used in chronic skin affection, chronic rheumatism, syphilitic affection, etc. *Ingredium used as hair irradiator.*

Sulphur passes unchanged from the stomach into the small intestines, and there is changed to a very limited extent into sulphuretted hydrogen which acts as a local irritant increasing peristalsis, the stools produced being soft and mushy, but not watery. It is used in case of piles and fistula in ano because of this action. By its use the absorption of food is not hindered, as is the case with many of the purgatives. The depressant effect is never so strong as to produce any poisonous results after its use. *It transforms constipated children.*

Sulphur with senna and liquorice in form of Compound Liquorice Powder is very largely used as a purgative.

Internally potassa sulphurata and solutions of the iodine compound have been used in some chronic skin affections and enlargement of the glands, but with negative results.

SODIUM CHLORIDE GROUP. The neutral salts of the alkalies which are easily soluble in water are divided into two groups according to their degree of diffusibility through animal membranes. Those salts which are readily absorbed belong to the sodium chloride group. To this group belong the following substances:

SODII CHLORIDUM, or common salt. Dose 0.300-4.000. *very sol in H₂O*
AMMONII CHLORIDUM, 0.150-2.000. *irritate.*
POTASSII CHLORIDUM, 0.300-4.000. *1.000*
LITHII CHLORIDUM, 0.150-2.000.
SODII BROMIDUM, 0.300-4.000. *✓ Potassium Bromide (same)*
AMMONII BROMIDUM, 0.150-2.000.
LITHII BROMIDUM, 0.150-2.000.
CALCII BROMIDUM, 0.300-4.000.
SODII IODIDUM, 0.300-4.000.
AMMONII IODIDUM, 0.150-2.000.
POTASSII IODIDUM, 0.300-4.000.
SODII NITRAS, 0.150-1.000. *1-2 20 per grain (?)*
POTASSII NITRAS, ~~0.300-300~~. *10 per grain 1-2*

All the above are soluble in from one to four parts of water. The dose for the ammonium and lithium compounds is only about one-half of that for the others and that of nitrate of sodium is half the quantity of potassium nitrate.

Prepared from potassium iodide is the
UNGUENTUM POTASSII IODIDE. Contains 12% of potassium iodide.
 From nitrate of potassium is prepared
CHARTA POTASSII NITRATAS, or potassium nitrate paper.

Their general or common action depends upon 1. Their solubility in water. 2. Their diffusibility. On account of these two properties they pass quickly into the tissues. Besides these two properties some of these salts are of special interest as they are normal constituents of the body. The difference in the diffusibility of the drugs generally depends upon their volatility. Nitrates are very diffusible, then chlorides, next bromides, and lastly the iodides.

Potassium salts are very diffusible, less so the sodium compounds. If one of these salts are applied locally, either in the pure form as acid salt or in concentrated solution, they will take up water from the tissue and penetrate into it, and in that way produce local action. This local action may bring about stagnation in the blood current and emigration of the formed elements of the blood, that is, produce a simple inflammation. Of course the degree of inflammation will depend upon the place of application, concentration and quantity of the salt used. These salts act by their physical properties. On account of their solubility in water, diffusibility and taking up water from the system they will change the current of the parenchymatous liquids and in this way make changes in the metabolism. Their main action and whole therapeutic value depends upon these physical properties. If the solutions are not too dilute they will cause a local irritation with the sense of heat, and in favorable cases sweating will result. This slight irritation which they produce on the skin is made use of in the form of salt baths and as a result of local stimulation there is a reflex stimulation of the metabolic processes. It is only the salt which acts. On account of this local effect salt baths either artificially prepared or in the form of natural saline springs are made use of in chronic skin diseases. Salts from the baths are not absorbed or only in smallest possible quantities from the skin, therefore the use of salts in this way to produce constitutional effects is not rational, even in the form of the ointment of potassium iodide is absorbed to but a slight extent. If the action of potassium iodide is desired, always give it internally as the only good effect produced by its external application is the massage produced by the rubbing.

The effects upon mucous membranes are much more intense. If given subcutaneously the nerves are first stimulated followed very quickly by a depressant effect, the latter being especially marked with potassium salts. More marked with the iodide and bromide, less so with the others, but always present. Taken internally these substances all have a salty taste. Peculiarity of these salts is, when taken internally, they take up water from the tissues and a sensation of dryness in the throat and thirst is produced, no matter from what point the application is made, and is probably due to some nervous influence. The thirst comes before the salts are excreted by the urine.

The secretions of mucous glands are affected in just the same way by members of this group as by alkalies, the mucus becoming less dense and tenacious. This peculiar action is made use of in atony of the stomach, anorexia, and catarrh of the stomach. This internal administration should not be continued for very long periods lest irritation and even gastritis be produced. If taken in large quantities inflammation and gastro-enteritis may follow especially with nitrate of sodium, which is classified as a poison simply on account of its more powerful local effect, the difference is only in quantity not quality of action.

When these substances reach the intestinal canal they act upon the mucous membranes and increase the peristalsis making defecation easier but as they are quickly absorbed their action will not be long continued and so the stools will be mushy but not watery. Sodium chloride on this account is especially valuable in case of hemorrhoids. The other salts are not so valuable in this respect as the quantity needed to produce this result is so large that a local irritant effect would also be produced.

On account of their rapid absorption in the small intestine only traces of them are found in the color.

All the members of this group act as diuretics. They take up water from the blood, and in order to replace this the blood takes up water from the tissues and so the current of lymph is changed in both the tissues and lymph vessels, increasing the metabolism as indicated by the increased amount of urea and on account of this beneficial influence these salts are given internally to help nutrition and increase metabolism in cases of chronic disease, especially syphilis, rickets and scrofulosis.

Certain of these salts have an added interest owing to their being constituents of the blood. Sodium chloride is contained in

the plasma and the corpuscles contain potassium salts. By the ingestion of large amounts of distilled water the sodium chloride of the blood may be reduced, but only to a certain extent. The remainder cannot be reduced, which is probably due to the fact that this salt is needed for the formation of gastric juice, bile, etc., and so the system holds back enough for its own protection.

Man and herbivorous animals have a natural craving for salt, while carnivorous animals do not. This is due to the fact the diet of the former contains large amounts of potassium salts which, after absorption decompose the sodium chloride of the blood, forming chloride of potassium and phosphate of sodium and so reduce the amount of sodium chloride in the blood.

In certain diseases the sodium chloride of the blood is diminished but our knowledge of these conditions is very limited. It is especially decreased in pneumonia, certain cases of chlorosis and cholera.

They are largely excreted with the urine, but a certain amount is excreted by the mucous membrane of the bronchi, making it valuable in catarrh of the air passage because of its local action.

The salts most used in these cases are sodium chloride, potassium iodide and to a certain extent potassium bromide.

In cases where the mucus is purulent the iodide of potassium three or four times a day makes it less tenacious and much more easily expelled. Care must be taken not to give it in too concentrated form. All to a certain extent have an antiseptic action, because by the loss of water the putrefactive changes are hindered.

The special action of the members of the sodium chloride group is based on the different bases and acids of the different salts. As bases we have to consider only the difference in actions of sodium and potassium. The sodium compounds are more diffusible than the potassium therefore the latter act stronger locally.

Sodium compounds are found in the blood, mostly in the plasma, while the potassium ones are in the solid elements. The same rule holds good in all the other tissues of the body. Potassium if injected acts only on the solid organs. Even in small quantities if injected its action is very toxic, mainly on the central nervous system, which is first stimulated and later depressed. The muscular apparatus also becomes depressed and the cause of death is its direct action upon the heart.

Sodium and potassium compounds can be given in large amounts by the mouth without toxic action because of their very rapid

excretion, but small amounts if injected, cause very serious results. One-tenth gram injected is sufficient to kill a cat.

Formerly potassium compounds were used to reduce the temperature in fever, but on account of their depressant action are now entirely abandoned for this purpose, the iodides and bromide of potassium have a special action due to the acid component. They are easily soluble in water and pass to a large extent unchanged through the body, being excreted in the saliva, sweat and urine. A small amount of potassium iodide is decomposed in the stomach by the hydrochloric acid present, setting up an irritation, so it is best given mixed with bicarbonate of soda to neutralize the acid and prevent the decomposition.

Potassium iodide must be decomposed in the system, probably forming an albuminate of iodine which may be found for some weeks after the administration of the salt has been stopped in the saliva, although no salts of iodine can be found. How or where this decomposition takes place is not known.

It has a strong influence upon the metabolism, which is still more marked in pathological cases. Whether this is due to the potassium iodide or the setting free of iodine is not known.

This action is especially marked on pathological conditions, due to syphilis, sometimes healing ulcers and removing large growths in a very short period. This is probably not due to any antisyphilitic effect, but probably because it acts more profoundly on the pathological process than on the normal tissue. Its beneficial action is very marked in skin eruptions due to syphilis, but not to such an extent in those due to other causes.

Untoward Effects are often seen after the use of Iodine or its compounds. These consist of catarrh of the respiratory passages, swelling of the nasal mucous membranes, a profuse watery discharge and sneezing. The gums are swollen and irritated and there is profuse salivation. The conjunctiva becomes swollen and congested and there is often intense frontal headache. These results are what is known as Iodism.

The coryza and swelling of the mucous membranes is supposed to be due to their excretion of the iodine compounds which are broken up setting iodine free. To avoid local irritation of stomach it is best to give iodine or its compounds well diluted in milk.

Some patients who cannot stand small doses may stand large ones very well. They may show excitement and cough with one gram doses,

but if these are increased to two or three grams these symptoms may all disappear.

If these salts are given for long periods, emaciation and cachexia may result. As soon as the patient begins to lose weight stop for two or three weeks and then begin again.

In excessive doses the heart may become weak due to the effect of the potassium. In cases of heart trouble substitute the sodium or ammonium iodide for that of potassium. The ammonium compound is the most irritant locally.

BROMIDES. All the members of the sodium chloride group have a depressant effect on the sensory ending. This is especially marked with the Bromides. They act not only locally, but also depress the central nervous system. In case the motor centres are excited potassium bromide will depress the excitability. Where reflexes of the motor centres are increased like epilepsy it is of value.

Whether action is due to the salt or free bromine is not known. When the depressant action of the potassium is too marked, the sodium or ammonium salt may be substituted for it.

All the members of this group are used in bronchitis to render the mucus less tenacious and dense.

Besides its use in syphilis iodide of potassium is used in goitre.

Iodine in the form of the tincture is used as a local irritant to relieve pain and swelling in rheumatism, inflammation of nerves, tendons, etc.

Bromides are used to depress the nervous system when unduly excited.

Substances of the sodium chloride group stimulate only the first part of the alimentary tract because of their rapid absorption. This slight stimulation may cause peristaltic movements of the stomach and so expelling the contents sooner than normally. This may explain the beneficial results that these salts have in gastric catarrh, ulcer and dilation of the stomach; the stomach being quickly relieved of its contents has a chance to rest and regain its tone.

Modern physiologists teach us that absorption from the alimentary canal is not to be confounded with diffusion. It depends upon the vital processes of the epithelial cells of the alimentary tract although diffusion plays a certain role in the processes of

absorption. The neutral salts are divided into two groups, the non-diffusible and slowly absorbed salts, the Sodium Sulphate Group; and the easily diffusible and soluble, the Sodium Chloride Group. The latter have already been treated of, so the Sodium Sulphate Group will now be considered. The members of this group are:

SODII SULPHAS or Glauber's Salt. ^{Has diuretic effect 1/2 - 1 gm.} colorless crystals containing a large amount of water of crystallization, effloresces on exposure to air and losing its water of crystallization.

SODII PHOSPHAS or Orthophosphate of Sodium. Colorless crystals which effloresce on exposure to air. Soluble in five parts of water.

POTASSII SULPHAS is found in some of the mineral waters. Only used in combination with other substances.

MAGNESII SULPHAS or Epsom Salts. Colorless crystals soluble in two parts of water.

MAGNESII CITRAS is never used as such but always in the form of Magnesii Citras Efferverscens, or granulated citrate, containing magnesium carbonate, citric acid, sodium bicarbonate and sugar. Soluble in two parts of water.

LIQUOR MAGNESII CITRATIS, a solution containing magnesium carbonate, citric acid, syrup of citric acid and potassium bicarbonate. The solution contains free carbonic acid and must be kept corked. Dose 50.-300. 250.

POTASSII BITRATRAS, or Cream of Tartar. This is the only salt not easily soluble in water, requiring 200 parts. Dose 5.-15.

POTASSII et SODII TARTRAS or Rochelle Salt, colorless crystals having a saline taste,

SEIDLITZ POWDER is an effervescing compound and is a mixture of rochelle salt, sodium bicarbonate and tartaric acid.

For purgative action the dose of all the salts is from ten to thirty grams, with the exception of the Potassium Bitartrate, the dose of which is one-half that of the others. They are all easily soluble, generally speaking, in about ten parts excepting the Bitartrate of Potassium which requires 200 parts.

Most of the salts combine with a certain quantity of water until they reach a fixed concentration of solution. They will take up water from the mucous membranes to reach the concentrations and by so doing will stimulate them, but will not cause irritation on account of their slow absorption, unless given in very large quantities. They prevent absorption of fluid from the intestine and also

attract water from the blood so that the mucous membrane is bathed in fluid.

Taken internally all the salts have a more or less bitter taste and may cause nausea, loss of appetite and vomiting. This must be taken into consideration as they are only used internally and never externally.

After severe hemorrhage from an operation, etc., the blood will be concentrated and the solution will be absorbed, and not produce the same effect.

Their therapeutic value depends upon their purgative action which action depends upon

1. The concentration of the solution.
2. The attraction of water from the intestine to the solution.
3. The slow absorption of the solution.
4. Slight stimulation of the mucous membranes of the intestinal tract.

On account of their slow absorption their effect will be produced on the whole of the alimentary tract from the stomach to the rectum, differing from the sodium chloride group the members of which, on account of their rapid absorption stimulate only the first part of the intestine.

The effusion from the organism to the intestine is not a simple process of diffusion. It depends first upon the concentration of the salt solution. If this is too dilute no water will be excreted by the intestine and therefore none taken from the blood. Upon the other hand it does not depend entirely upon this concentration of the solution, for if for any reason there is a lessened quantity of water in the blood none will be poured out into the intestine..

If there is a sufficient quantity of water in the intestine none will be taken from the blood.

Again, if the salts are used in the chemically pure form then no diffusion of liquid from the blood into the intestine will take place, which would be the reverse if the process was one of simple diffusion, but the salt will be absorbed into the blood. If in very dilute form they will also be absorbed so that in order to produce this purgative action they have to be used in a three to five per cent. solution.

Diffusion of the blood to the intestine depends upon the con-

centration of the solution the amount of the salt used and the actual concentration of the blood.

If the solution is of the proper strength (3-5%) and if the blood contains enough water the solution will pass from the stomach into the intestine and will prevent the absorption of water and the whole contents will be expelled in liquid form.

If the patient is given thirty grams of salt and no movement results, give him three or four glasses of water and the desired result will be produced.

The purgative effect is best seen in subjects where the tissue contains an excess of fluid as in dropsical condition.

They have no effect upon the general metabolism on account of their slow absorption and rapid excretion. After absorption they are excreted by the kidneys and will produce a slight diuretic effect. When purgation follows the administration of one of these salts it is absorbed to but a slight extent most of it being excreted with the faeces. The general metabolism may be influenced indirectly by the salts. When used in doses of from twenty to thirty grams for several days the intestine is cleared of any irritating substance or bacteria it may contain, thus relieving any disturbance caused thereby.

In using these salts not only the harmful products are removed but also any food stuffs that may be contained in the intestine as well. This fact will account for their fat reducing action, as the body will use up fat from its own store and so the body weight decreased.

On account of the local stimulation of the intestines more blood will be brought to them relieving other organs which may be congested or inflamed, and on this account are used in inflammation of the liver and lungs, hyperaemia of the kidney, etc. Magnesium when injected directly into the circulation will act as a poison.

WATER. The importance of water as a therapeutical agent is very great. In speaking of water the ordinary drinking and wash water and not distilled water is meant. Distilled water has a disagreeable taste, is a foreign substance to the organism and may have poisonous effects. Ulcers treated with distilled water become irritated and fish kept in it generally die. If taken internally in large quantities it may cause functional disturbances of the

mucous membranes and diarrhoea. Distilled water is not at all such a harmless water as is imagined.

It absorbs soluble salts and takes up from the organism all the soluble matter and makes changes in the constitution of the tissue. The amount of chemical substances dissolved in ordinary drinking water is so small that they have no therapeutic value.

The action of mineral waters depends mainly upon the salts dissolved in it and not upon the action of the water as such. Its therapeutic value is not always depended upon its chemical reaction.

Water is very often used upon account of its physical and mechanical action. Externally it is used to absorb and convey heat to and from the body, and for ordinary cleansing purposes to remove the different excretory products as sweat, fat, parasites, pathological products, etc., from the skin.

In cases where the action of water on the skin is prolonged, the epidermis becomes soft and swollen, especially in those cases where the skin is diseased.

In pathological conditions of the skin water is used as general or partial baths.

The latter are used in cases of ulcer, hemorrhages, etc. General baths are used in skin diseases to swell and soften the upper layers so that they may be more easily removed and the regeneration accomplished easier.

Many experiments have been made to determine whether water is absorbed from the skin. Apparently it does not, but after prolonged use the skin probably does imbibe some. The excretion of water through the skin is for the time being inhibited, and the excretion from it which is constantly taking place is prevented. The increased desire to micturate is not due to an increase of water in the system, but as a result of circulatory changes and the prohibited excretion of sweat. Nothing that the bath contains is absorbed any more than is the water, although the contrary is affirmed by those in control of many mineral springs. If anything has been absorbed in these cases it has been through the mucous membranes, vagina, etc., or from some place where the superficial layer of the skin has been removed. Neither water nor chemical salts are absorbed from the unbroken skin.

After baths sweating is generally increased. This is probably due to the fact that sweating has been prevented for a time and

that the upper layers of the skin have imbibed a little water. How much of this is due to the change and circulation after a bath is not known.

This sweating may lower the temperature, relieve congestion and induce sleep, and on this account baths are often of use in acute and chronic fevers.

Vapor baths act upon the skin in the same manner as warm baths. The inhalation of the vapor may cause increased respiration and pulse, and sometimes dyspnoea, headache, unconsciousness and even an apoplectic stroke may follow. Vapor baths should be taken with caution, especially by those patients who are liable to congestion.

Some persons have no tendency to sweat after vapor or warm baths. In cases of this sort the patient should be put in a warm bath and the temperature raised as high as the patient can stand, and the desired result will generally be obtained after the patient is put into a warm bed.

Profuse sweating causes a large loss of water from the organism, the blood volume will be decreased and therefore the pressure, the circulatory organs will be less active and all the secretions will be decreased, especially the urine which becomes darker and more concentrated, which fact must be taken into consideration in treatment of patients with kidney disease.

Warm baths are used to produce sweating in gout, acute rheumatism, and in all dropsical conditions due to heart or liver trouble.

The inhalation of the vapor of water is made use of in many cases where the mucous membranes are dry and inflamed, thus preventing the loss of water which is constantly going on from them.

The use of water as a means of quenching thirst needs no mention. If a little acid is added to it the result may be more prolonged as acids increase the flow of saliva.

Water when taken internally is quickly absorbed. This takes place almost entirely in the intestine and not in the stomach. The more concentrated the solution the easier it is absorbed from the stomach; the reverse is true of the intestine. Intestinal indigestion is often caused by a lack of water and is generally relieved and often cured by the taking of an increased amount of it.

Water taken with the meals is rather slowly absorbed, but if

taken on an empty stomach passes quickly through it to the intestine and is quickly absorbed, and a desire to urinate is very soon felt. In diarrhoea the ingestion of large quantities of water may increase it, but constipation may be cured by taking more water as it prevents the inspissation of faeces, thus removing the cause.

Ingestion of large quantities of water increases the metabolism thus increasing the solid constituents of the urine as well as the fluid portion. This effect is made use of in the different mineral spring resorts. On account of the large increase of water taken at these places the metabolism is increased and certain chronic diseases, such as rheumatism, may be favorably influenced by this.

This increase only occurs for a certain space of time and cannot be kept up indefinitely as after three or four weeks it will return to normal. On this account physicians advise their patients to remain at Carlsbad and other such springs not over twenty-eight days as by that time their effects have passed off. If the treatment is stopped for a time the same effect will be produced upon its resumption.

In diseases of the genito-urinary tract a concentrated urine increases the irritation. This may be relieved by the ingestion of more water, as this increases the quantity and consequently lowers the specific gravity. This may also prevent the formation of calculi or assist in their removal by mechanical means.

The increased ingestion of water can only cause a slight increase of water in the blood as the excess is rapidly excreted by the kidneys.

The restriction of water with meals, giving it only between them, is one of the methods for reducing obesity. Fluid is necessary to the digestion and absorption of food, and by this means they are hindered, as digestion occurs within two or three hours after the ingestion of food, thus causing the body to draw on the stored up fat for its support.

Water is used as a means to convey or abstract heat from the body. Hot water is used to convey heat to the body to cause dilation of the vessels of a part and to relieve congestion of parts farther away. Hot water footbaths often relieve suppressed menses by relieving the congestion of the abdominal organs. Hot baths may also be used to relieve excessive muscular contraction.

Cold water is used to abstract heat from the system and cause contraction of the vessels when congested. Cold baths are used to

a large extent in typhoid fever for reducing the temperature. Ice and snow are used to stop hemorrhage by contracting the blood vessels.

The effect of mineral water depends upon the quantity and quality of the salts they contain, and act in just the same manner as ordinary water in which the same amount of the same salts was dissolved would act. Those containing chlorides will be easily absorbed on account of their ready diffusibility will effect only the upper part of the intestine, and those containing salts not readily absorbed will act the same as the sodium sulphate group causing watery stools. Water containing sulphides or sulphuretted hydrogen will act in the same manner as sulphur as their action depends upon the sulphur they contain.

Carlsbad water will have no more effect than artificial Carlsbad water prepared here. The action of natural salts does not differ from that of artificially prepared ones. The good effects which mineral springs have is not because of some secret power they possess, but because of the surroundings of the place. The patient drinks more water than usual and the metabolism is increased for a time and the system flushed out. Much of the benefits derived from mineral springs is because of the change of scenery and surroundings.

Mineral Waters may be divided into four classes according to the salts they contain:

1. Those containing Chlorides.
2. Those containing Carbonates and Bicarbonates.
3. Those containing Sulphates.
4. Those containing Sulphides Hydrogen Sulphite and Carbonic Acid.

The value of a spring depends upon the salts it contains, the amount of them contained and its temperature.

ACIDUM CARBONICUM or Carbonic Acid Gas. Being a gas it passes easily through animal tissues, and as it is only a weak acid the irritation produced is but slight, and is felt most upon portions of the skin which is rich in nerves such as the genitals. It is only used in the form of baths when it is found naturally in the water, it is never artificially prepared for this purpose.

It is used at mineral spas for chronic rheumatism, diseases of the spine, uterus, etc., and in all chronic diseases, but the irritation produced has no advantage over any other irritant.

Local Action is stronger on mucous membranes and in pathological conditions of the skin, such as ulcers. If ulcers are bathed

with water containing it the irritation is quite marked for a time, but is followed by anesthesia on account of the paralysis of the sensory nerves.

Its effect upon the nose and mouth is quite marked and when taken into the stomach a sensation of warmth is felt. Used in nausea, vomiting and in some forms of catarrh of the stomach but in the latter case it is usually given in combination with some alkali.

The absorption of carbon dioxide from the stomach is slight, as most of it is lost in the pouring out of the water and in eruction from the stomach and amount absorbed is never sufficient to change relatively or absolutely, the amount in the blood and therefore constitutional effects are not seen.

Inhaled as a gas the effects produced are quite different. The glottis closes as a result of reflex action and death results from asphyxia preceded usually by convulsions. The value of Carbonic Acid is that water is much more readily absorbed if it is charged with it and so it is useful in kidney and other diseases when an increase in diuresis is desired. This increased diuresis is due to the greater amount of water absorbed and not to the Carbonic Acid.

Air normally contains about .05 volume per cent of carbon dioxide. If this is increased to 1. volume per cent, toxic effects will be seen, and air containing 26% is absolutely poisonous.

ALUM GROUP. Belonging to this group are all the different compounds of Alumen. Those which are soluble in water have a nearly identical action to tannic acid and its derivatives. They precipitate albumen and other organic substances, the precipitate being insoluble in water and not easily affected by chemical reagents. They do not diffuse easily and are absorbed only in the slightest traces, therefore their action is mainly a local one. When applied to bleeding surfaces or mucous membranes, on account of their action on albumen and other organic matters, they form a hard layer which contracts easily and in contracting will compress the tissues underneath, thus acting as haemostatics in the first instance and astringents in the second, by hindering the pouring out of the secretions, and on this account be very useful in inflammation and other conditions when the secretions of the mucous membranes are increased. They are used for local effects only, having no constitutional action on account of their non-absorption.

ALUMEN, or common alum, is the sulphate of alum and potassium,
 $\text{Al}_2\text{K}_2(\text{SO}_4)_4$

crystallizable and soluble in ten parts water, insoluble in alcohol, strongly astringent and of a sweetish taste.

If the water of crystallization is driven off it is called burnt alum or

ALUMEN EXSICCATUM, or ^{.5-2}Alumen Ustum, soluble in 25 parts water.

ALUMINI HYDRAS, a light powder, insoluble in water or alcohol.

ALUMINI SULPHAS. crystalline, soluble in one and a half parts of water.

Besides the official preparations the following are also used:

ALUMINI ACETATIS, used only in watery solution, containing from one-fourth to one per cent. of the acetate.

ALUMINI CHLORIDI, or Chloralum, is a very unstable crystalline substance giving off hydrochloric acid on exposure to air.

ALUMNOL, or Aluminum Naphthol Sulphonate, whitish powder freely soluble in cold water.

Chloralum and Alumnol are only used externally, for internally use either the Sulphate or Hydrate. On account of its local action Alum and its compounds are used as antiseptics, haemostatics and astringents. In concentrated form the astringent action may be slightly caustic and are therefore used to cauterize exuberant granulative tissue, ulcers, etc.

On easily accessible mucous membranes alum may be used in powdered form or in one to three per cent. solution, never use over a three per cent. solution, as the astringent effect would be lost on account of the inflammation caused by the stronger solution. On the mucous membranes of the nose it may be used in the form of snuff.

For internal use the dose is one to two grams two or three times a day but never over four grams at once lest vomiting be caused.

PHOSPHORUS cannot be grouped with any other substance. It is a whitish waxy solid, insoluble in water, scarcely soluble in alcohol and ether, soluble with difficulty in fats and ethereal oils, readily soluble in carbon disulphide, melts at 44°C, exposed to air it emits white fumes with a very disagreeable odor resembling garlic.

AMORPHOUS or Red Phosphorus is non-volatile, insoluble in all liquids and therefore has no action whatever on the system.

The ordinary phosphorus is very active. Dose 0.0005-0.0010 and as much as 0.005 per day, best given dissolved in oil or in the form of pills. The U. S. P. contains four preparations, but the following is all that is necessary to remember.

PILULAE PHOSPHORI, each contains 0.0006. *& also the same dose.*

Phosphorus has a local and constitutional action. When very finely powdered, upon the skin it causes heat and burning, and with large quantities the local irritation will cause exudative inflammation. Two or three milligrams dissolved in the mouth causes a sensation of heat and garlic-like taste which persists for some time.

If the fumes of phosphorus are inhaled for some time the continued local irritation may cause necrosis of the lower or upper jaw, as a rule starting in the neighborhood of a carious tooth. Why women are affected in this way more than men is not known. The first symptoms noticed are swelling of the gums followed by pus formation. In the air it oxidizes quickly, more so when warm than cold. It is not quickly oxidized in the stomach and its local action here is not marked, but if the stomach is empty it may cause vomiting. In the small intestine the local irritant action is more marked and may cause intense inflammation and exudation of blood. This is due to the fact that it is soluble in 3,000 to 5,000 of bile while it requires 500,000 parts of water to dissolve it, and therefore as soon as expelled into the intestine will be quite rapidly dissolved and produce a much severer action than in the stomach.

Constitutional effects are very slow to appear and are due to the action of phosphorus as such in the blood. It is absorbed in the form of vapors and as it is oxidized only slowly in the stomach its absorption is also slow. After its absorption it acts mainly as a metabolic poison causing fatty degeneration of all the glandular organs especially the liver. This is not due to its local effect but occurs only after absorption into the circulation. The urine contains more nitrogen although the amount of urea is decreased. This is due to the presence in it of the pathological products leucin, tyrosin and lecithin, thus increasing the nitrogenous excretion.

In very rare cases so-called acute poisoning may occur. Here death is due to paralysis of the heart and in such cases no fatty degeneration is present. The motor ganglia are first affected and later the heart muscle itself, the pulse becoming slow and the blood pressure lowered. In chronic cases, after three to five days or later, there is a decrease in pulse rate and blood pressure which is the sequel of the metabolic changes.

Uses. Phosphorus is used in cases when the bones are softer than normal, to harden them, the spongy portion becoming harder and

denser after its use. As a rule it must be given for a long period in small doses, one pill three or four times a day, never in large doses as they may produce fatty degeneration of the kidney. It is also used by some in chronic nerve troubles.

HEAVY METALS. These will be studied now from a general point of view, later their special actions will be taken up. They are used extensively in Therapeutics and have also a toxicological interest. Within the last twenty years their actions have been studied experimentally, but as yet many of their actions cannot be explained, therapeutically or experimentally.

All the heavy metals show one characteristic general action, a strong affinity for albuminous bodies. When the salt of a heavy metal is added to a solution of albumen the albumen is precipitated, the precipitate being soluble in excess of albumen, acids and alkalies, and is a definite chemical product.

The degree or severity of the action of a metal salt depend upon the place of application, the strength of the solution and the substance used. In dilute solutions they are simply astringents, acting very similar to tannic acid. In strong solutions they produce a caustic and irritant action, and destroy the tissue.

If such a caustic effect is produced in the gastro-intestinal tract, intense inflammation is produced and death may result, the case being spoken of then as one of ACUTE METALLIC POISONING. Death in these cases is due to the caustic action and does not differ from that due to any other caustic, as sulphuric acid, etc. It is only in cases of arsenic and antimony poisoning that any constitutional effects are seen.

If death is produced acutely with any of the other metals it is due to the local caustic effect only, but arsenic and antimony produce not only a local caustic effect, but also a constitutional action after absorption.

Chronic cases of poisoning do not show any other characteristic than starvation due to impaired metabolism.

Heavy metals, if given in small quantities, cause only a slight local action, and as they form compounds with albumen which are soluble in excess of proteid may be absorbed, and after absorption are retained in the system for long periods, as a rule, and are later excreted by the mucous membrane of the intestines as organic metallic compounds, as they cannot be oxidized in the system.

CHRONIC POISONING is probably due to the retained heavy metals in the system. The general action of the heavy metals has been

studied in animals by the intravenous or subcutaneous injection of their double salts; simple salts cannot be used to account of their local effects, while the double salts do not cause precipitation of the albumen, and so can be made use of. The simple salts if injected into the blood would precipitate the albumen and cause emboli. The double salts of lead cannot be used as they are precipitated by the carbonates. In place of the double salts an organic metallic compound may be used, as here the affinity for albumen has been satisfied. Experiments with these proved for the first time that the action of these metals was due to their presence in the system and not to the gastro-intestinal disturbance.

The heavy metals either stimulate or paralyze the muscular or nervous tissue, some having a stronger affinity for muscular and others for nervous tissue, and this difference in their affinity after absorption necessitates a subdivision of them.

The first group or subdivision consists of copper and zinc.

CUPRI SULPHAS, large blue crystals, almost insoluble in alcohol, soluble in three parts of water, and is sometimes called Blue Vitriol. Dose as astringent, 0.020 - .1 *Caustic & emetic up to 1. Divided doses in H₂O.*

ZINCI CHLORIDUM, whitish granular powder, very deliquescent, very soluble in water and alcohol.

LIQUOR ZINCI CHLORIDI, contains 50% of Zinci Chloridum.

ZINCI SULPHAS, or white vitriol, colorless crystals, very soluble in water, insoluble in alcohol. Dose as astringent 0.020, as emetic up to 2.000 *1/2 gm in water repeated 3 times.*

ZINCI OXIDUM, amorphous white powder, insoluble in water and alcohol.

UNGUENTUM ZINCI OXIDI, containing 20 per cent. of Zinc Oxide.

OLEATUM ZINCI, containing 5 per cent. of Zinc Oxide.

The affinity of the members of this group for proteids is very strong. In dilute solutions they act as astringents; stronger as caustic. The action of the salts of the heavy metals depends not only upon the metals but also upon the acids which form the compound.

Zinc Chloride when it comes in contact with albumen forms an organic metallic compound and the hydrochloric acid is set free, therefore we have not only the astringent effect of the zinc but also the irritant action of the acid, also with zinc sulphate there is an astringent action plus the action of sulphuric acid.

Zinc oxide acts simply as an astringent. Zinc chloride is a powerful caustic and in stick form with plaster of paris, is used

to destroy new growths. The Liquor is also used for the same purposes.

The astringent effect of copper sulphate is used in inflammation of mucous membranes, especially of the genitals. Sulphate of zinc in the proportion of 1 to 200 is more generally used for the same purpose. The astringent action is made use of in small doses to check diarrhoea, but the newer astringents like Tannalbin is better and can be used in larger quantities.

Copper sulphate is used in dilute form to destroy granulations of eyelids and fused with silver nitrate where a strong caustic are desired.

To produce vomiting, copper and zinc sulphate are used, given in doses of 0.100-0.200 every five minutes until vomiting results. If vomiting is not produced in half an hour, remove them from the stomach, otherwise the local irritant effect will be too marked. Vomiting occurs as a result of their action on certain nervous elements of the stomach, and not as a result of the local irritation produced, because large quantities may be taken and vomiting not result.

Copper and zinc in large quantities cause vomiting; in small quantities they are excreted from the system quicker than any other metals, and on this account chronic poisoning does not occur.

If double salts of copper or zinc are injected directly into animals, paralysis of all of the striated muscles and also the heart results and death is due to asphyxia.

ZINCI VALERIANAS is used internally for constitutional effects in nervous disorders, especially of the convulsive type as epilepsy, hysteria, etc., always in small doses of 0.020. How it acts in such diseases is not known. *May act by producing muscular relaxation.*

The next group consists of BISMUTH and its Preparations.

BISMUTHI SUBCARBONAS is a white powder, odorless, tasteless and insoluble in water or alcohol.

BISMUTHI SUBNITRAS, white powder, odorless, nearly insoluble in water but soluble in hydrochloric acid.

BISMUTHI CITRAS, white powder, insoluble in water or alcohol and used in the form of

BISMUTHI et AMMONII CITRATIS, shining scales, very soluble in water.

Non-official preparations are BISMUTHI SALICYLAS amorphous white powder, insoluble in water, but easily decomposed by acids.

SUBGALLATE OF BISMUTH, or Dermatol, is a yellow powder, odorless, contains about 50% of bismuth, and is insoluble in water.

TANNATE OF BISMUTH has also been prepared recently.

The neutral salts are decomposed by water forming basic salts. Basic salts and the insoluble compounds of bismuth are slowly decomposed with the liberation of free acid, the latter acting as a mild astringent. On the unbroken skin the soluble and insoluble compounds have no action. On mucous membranes and ulcerated surfaces they act only as astringents, and as their decomposition is slow their action will be prolonged. Internally their actions will be far-reaching, affecting not only the stomach but the whole length of the small intestine.

In the large intestines their action is not marked. Their astringent effect is made use of in catarrhal affections of the stomach and small intestine. In these conditions they are given either in powder or in emulsion, 0.500-1.000 a dose, repeated five or six times per day. Sometimes small quantities of opiates are added with good advantage, as they decrease the peristaltic movements, and so the astringent action will be prolonged. In severe diarrhoea, dysentery and gastric ulcers bismuth should be used always in powder form and in large doses up to 20-40 grams per day; preferably the subnitrate. The subnitrate is broken up, setting free nitric acid, which acts as an antiseptic, the bismuth acting only mechanically by forming a thin film over the surface.

The subnitrate and salicylate in suspension are used in gonorrhoea, the solution decomposing with the continuous liberation of acid, the acid acting as an astringent and antiseptic. Constitutional effects are unknown.

In animals by subcutaneous or intravenous injection, acute constitutional effects are produced tonic and clonic convulsions, at the same time the heart muscle becomes paralyzed and blood pressure falls. In chronic cases the symptoms are only in the gastro-intestinal tract, diarrhoea, ulceration of the small and large intestine with the disposition of the black sulphide of bismuth in the latter, later inflammation of the kidneys, progressive loss of flesh, convulsions and death.

In human beings bismuth poisoning is rare, two or three cases of death are reported from local application, but none where it was given internally. A large number of cases of bismuth poisoning have been reported but they were caused by impure bismuth containing arsenic or lead, and not due to the bismuth.

Soluble bismuth compounds are not necessary for the therapeutical purposes and it is used only for local and not constitutional action. Formerly bismuth was given in nervous diseases but its use is now abandoned.

In some cases bismuth contains a trace of tellur and in such cases the person's breath smells like garlic, but this is due to the tellur.

LEAD GROUP. PLUMBUM or lead is used in practical therapeutics for its local astringent action and not for constitutional effects, but these constitutional effects are important because of the frequency of chronic lead poisoning. The preparations are

PLUMBI OXIDUM, or Litharge, yellowish or yellowish-red powder, nearly insoluble in water, soluble in nitric and acetic acids.

EMPLASTRUM PLUMBI is practically an oleate of lead and is sometimes called Diachylon. . 06

UNGUENTUM DIACHYLON contains oleate of lead and olive oil.

PLUMBI ACETAS, or Sugar of Lead. Crystalline substance, efflorescing and absorbing carbon dioxide when exposed to the air. Characteristic sweetish taste which is first astringent and water metallic, soluble in two parts of water.

LIQUOR PLUMBI SUBACETATIS, or Goulard's Extract contains about 25 per cent. of the subacetate of lead.

LIQUOR PLUMBI SUBACETATIS DILUTUS, or Lead Water, contains about 3% of Goulard's Extract.

CERATUM PLUMBI SUBACETATIS, or Goulard's Cerate.

PLUMBI CARBONAS, a heavy white powder, insoluble in water.

PLUMBI NITRAS, soluble in water, almost insoluble in alcohol.

PLUMBI IODIDUM, bright yellow powder, soluble in 2,000 parts of water.

UNGUENTUM PLUMBI IODIDI (10% of the Iodide).

The only important soluble salts are the acetate and subacetate. The acetates have strong affinity for albuminous substances, and local action will be very marked. The absorption is very slow, and after absorption are retained for a long time. Even minute quantities if taken for a long time will cause chronic poisoning on account of the slow excretion. No matter whether soluble or insoluble compounds are injected, small quantities are always absorbed from the gastro-intestinal tract or other mucous membranes, this explains the general occurrence of lead poisoning.

In mucous membranes and ulcerated surfaces if the soluble salts

are used in small quantities there will be an astringent effect. Larger quantities act as caustics similar to copper and zinc and may be so severe that acute poisoning may occur, in which cases the symptoms are due only to the local irritant effect and not to the specific action after absorption. Lead compounds are never used in large quantities and so acute cases of poisoning are rare.

The astringent action of the lead is made use of on mucous membranes to decrease the pathological increase of the secretion. In the nose the acetate is used as a snuff; in catarrhal conditions of the stomach and intestines it is best given in pill form in doses of 0.060-0.100, and in inflammation of the urethra, in the form of an injection. In cases of ulcers the acetate or subacetate is made use of locally applied, forming a protective layer, and stopping hemorrhage if present. Lead acetate can only be given for a short time lest chronic lead poisoning follow. It has occurred in cases when less than 0.500 have been taken. Lead iodide has been used in the treatment of scrofulous ulcers in order to get the combined effect of the lead and iodine but the results are not very favorable, as the insoluble lead compounds will have no constitutional effects as long as it is undecomposed. To get the best results give iodides internally and apply the lead externally.

Lead nitrate has been used in place of silver nitrate, but does not work as well. The acetate and subacetate only are used in practical therapeutics. Double salts of lead cannot be used subcutaneously, as the carbonate in the blood precipitates the lead. After repeated experiments it was found that lead tri-ethyl could be injected without local irritant effect.

The constitutional effects in chronic lead poisoning are very complex. Symptoms are found in the gastro-intestinal tract, muscular and nervous systems. In the gastro-intestinal tract, constipation and colicky pains; nervous and muscular systems are first stimulated and later depressed. The symptoms of stimulation are pain and contractions in the different muscular groups especially those near the joints, followed later by symptoms of paralysis. Later the central nervous system is paralyzed, showing metabolic changes. The effects are very complex, as certain symptoms are very marked in some cases while in others they are absent. Sometimes the gastro-intestinal tract is affected, in others the muscular system and in still others the nervous system, with blindness and occasionally epileptiform convulsions.

In acute cases of poisoning when it was possible to get the convulsive contractions they could be relieved by atropine, show-

ing they were due to the motor ganglia. In human beings the pulse rate is low but of good volume, its fullness being due to the contraction of the abdominal organs, thus driving more blood into the general circulation. By the use of amyl nitrite the blood vessels are made to dilate and the blood is more evenly distributed, with a resultant fall in pulse volume, showing that its volume before was due to the lack of blood in the abdominal viscera. In acute lead poisoning constipation is not present. Nervous and muscular symptoms are seen in animals in acute cases, first stimulation and later paralysis of the heart causing death.

The symptoms in chronic lead poisoning are not due to local irritant action but to the specific constitutional effect after absorption.

TREATMENT of POISONING. In acute cases when lead has been used in soluble form it should be transformed into an insoluble compound by the use of sulphate of magnesia or sodium, then removed by an aperient. In chronic cases iodide of potassium should be given as this increases the excretion of the lead. How it acts is not known.

Lead is used only locally. In former years on account of its local hemostatic effect it was given in hemorrhage from internal organs but its use in this respect has been entirely abandoned.

SILVER and GOLD GROUP. The official preparations are ARGENTI NITRAS, colorless crystals, very soluble in water, very easily decomposed by alkalis, carbonates, chlorides, etc. Dose, internally, 0.010-0.050.

ARGENTI NITRAS FUSUS, or lunar caustic, moulded nitrate of silver, generally in the form of pencils.

ARGENTI NITRAS DILUTUS, prepared by fusing silver and potassium nitrates and casting into suitable moulds.

ARGENTI OXIDUM, Argenti Cyanidum and Argenti Iodidum, are also official but are not important. Not official but used extensively are a few organic compounds.

ARGONIN, or caseinate of silver, used in 1-2% solution.

ITROL, or citrate of silver, used in 1-2% solution.

Silver nitrate should only be used locally. Its action is much more marked on mucous membrane than on epidermis.

AURUM, or gold. The preparation is

AURI et SODII CHLORIDUM, a yellow powder, very soluble in water. Dose, 0.002-0.006.

Silver compounds are used mainly for local effects; gold is

sometimes used for constitutional effects. The soluble salts, especially silver nitrate, have a very special affinity for albuminous substances, forming a dense and hard albuminate which is insoluble in excess of albuminous matter; their action therefore is local and will not penetrate deeply into the tissue on account of the insolubility of the albuminate. A certain amount of pressure is exerted on the tissue underneath, and will stop bleeding if present; therefore they are termed hemostatics. In very dilute solutions they act only as astringents. Argonin and itrol are not as caustic as the other compounds of silver, as their affinity is already partially satisfied. Silver nitrate in solution or solid form is used in diseases of the skin, fissure, warts, corns, chancres, etc.

It does not diffuse like the hydrates of potassium and sodium but acts only locally and superficially. Its effect is more marked on mucous membranes and ulcerated surfaces.

In urethra and vagina, watery solutions of one-fourth to one-half per cent. should be used. For inflammation of the rectum, use large enemas containing one-tenth per cent., and throat use silver nitrate in watery solutions or powders. In catarrh of stomach it is best used in the form of spray with aid of stomach tube and in ulcers of stomach in pill form freshly prepared with bolus alba as excipient. Only a small amount will pass into the intestine as it will be largely transformed into silver or chloride of silver in the stomach. The absorption of silver is very slow from the gastro-intestinal tract, but after prolonged use will be absorbed and deposited in the skin as dark brown spots. Such a condition is termed Argyria, and only occurs after 25-30 grams have been given. It is very slowly excreted if at all, so that a patient who has taken altogether 25-30 grams will have Argyria even if long periods have elapsed between the administration, patients therefore should never be given over fifteen grams lest this discoloration which is permanent be produced.

Our knowledge of the constitutional effect of silver and its compounds is limited. Internally it acts as a depressant to the central nervous system and death is due to paralysis of the respiration. No constitutional effects have been produced in human beings, except the discoloration of the skin. Silver nitrate is used in certain nervous diseases, as epilepsy, etc., whether it does good or not is not known. The citrate and caseinate is used in the treatment of gonorrhoea, acting on the gonococcus better than silver nitrate as its affinity for albumen is already satisfied.

Gold chloride forms a purple albumen of gold, which is readily soluble in excess of albuminous material, therefore its local caustic action will be very severe and not localized and will cause inflammation and necrosis of tissues. Internally will cause a severe gastro-enteritis. Gold is not used locally. Its constitutional effects are not known, but it has been given in nervous diseases.

Cases of acute poisoning by silver nitrate should be treated by giving something which will transform it into an insoluble compound, and this is most readily accomplished by the use of common salt; this precipitate must be removed as the silver chloride is observed after a time.

MERCURY GROUPS. HYDRARGYRUM is one of the few substances that is used in the form of a metal. U. S. P. has five official preparations containing metallic mercury:

HYDRARGYRUM cum CRETA, or Grey Powder, is a mixture of prepared chalk, with 38% of mercury. Dose 0.060-0.600.

MASSA HYDRARGYRI, Blue Mass, or Blue Pill, containing 33% of mercury, besides some inert substances. . 05 - 1

UNGUENTUM HYDRARGYRI, or Blue Ointment, containing 50% of mercury.

EMPLASTRUM HYDRARGYRI, or Plaster of Mercury.

EMPLASTRUM AMMONIACI cum HYDRARGYRI contains a large quantity of gum resin.

There are two oxides in U. S. P.

HYDRARGYRI OXIDUM FLAVUM, or Yellow Oxide of Mercury, from which there is prepared

UNGUENTUM HYDRARGYRI OXIDI FLAVI, containing 10% of Yellow Oxide of Mercury. *Used externally* 1-2

OLEATUM HYDRARGYRI, containing 20% of mercury. *Externally*

HYDRARGYRI OXIDUM RUBRUM, or Red Oxide of Mercury, of which there is .001 - .006

UNGUENTUM HYDRARGYRI OXIDI RUBRI. It contains 10% of the Red Oxide.

Of the salts there are the

HYDRARGYRI CHLORIDUM CORROSIVUM, or Corrosive Sublimate, or Bichloride of Mercury, colorless crystalline masses permanent, in the air, and soluble in 16 parts of water and in three parts of alcohol. Dose 0.001-0.006.

HYDRARGYRI CHLORIDUM MITE, Calomel, or Mild mhloride of Mercury, white powder, permanent in the air, odorless and tasteless. Insoluble in water, alcohol and ether. Dose 0.030-0.300 and as much as 1.500 in 24 hours. *Fin local effects in intestines.*

1. m

There are two official pills containing mercurous chloride:

PILULAE CARTHARTICAE COMPOSITAE, or Compound Cathartic Pills, containing extract of colocynth, 0.080, extract of jalap, 0.030, calomel, 0.060, and powdered gamboge, 0.015. Dose 1-3 pills.

PILULAE ANTIMONII COMPOSITAE, or compound pills of antimony, and contains sulphuretted antimony, 0.030, calomel, 0.030, guaiac, 0.060, and castor oil. Dose 1-2 pills. 24 hrs.

IODIDES of MERCURY. HYDRARGYRI IODUM FLAVUM or yellow Iodide of Mercury is an amorphous powder, tasteless and odorless, insoluble in water, alcohol and ether. Dose 0.001-0.006.

HYDRARGYRI IODUM RUBRUM or Red Iodide of Mercury is an amorphous powder almost insoluble in water, but soluble in a solution of Potassium Iodide.

There are five or six others of which the most important are HYDRARGYRUM AMMONIATUM or White Precipitate is used in the form of

UNGUENTUM HYDRARGYRI AMMONIATI containing 10% of the white precipitate.

Mercury and its compounds act locally at the place of application and constitutionally after absorption, the constitutional effects being more or less identical. The local action depends entirely upon the preparation. As a rule they act as irritants and caustics, the astringent effect only following a few of the insoluble compounds. They have a great affinity for albumen to form albuminates which are soluble in excess of albumen, therefore they act as irritants and caustics and at the same time infiltrate and penetrate deeply into the tissue. The insoluble mercury compounds, like iodide and oxide act as local caustics which is due to the fact that they are probably transformed into soluble compounds by the different secretions. Mercury when rubbed into the skin is absorbed but in the form of an albuminate. Insoluble calomel is absorbed if given internally by being first transformed into a soluble albuminate and constitutional effects may follow the use of small quantities; large doses act only as aperients.

The strong affinity of mercuric compounds for albuminous matter makes them valuable as antiseptics, disinfectants and antiparasitics. For antiseptic and disinfectant purposes use corrosive sublimate in solutions of 1 to 1000, or 1 to 2000. To disinfect large surfaces of mucous membranes, as vagina, etc., or ulcerated surfaces, use it in the strength of 1 to 5000, or 1 to 10,000.

For antiparasitic purposes use one of the four or five ointments of mercury. The stimulating effect of mercury is made use of

in badly healing sores and ulcers by sprinkling calomel over their surface. Local action in the alimentary tract is not made use of below the mouth except in the form of calomel, which in large doses (0.01 or over) causes evacuation of the bowels. How this effect is produced is not known, whether the motor ganglia of the intestine is stimulated or whether it is transformed into a soluble albuminate which produces local irritation.

The constitutional effects of mercury are more or less identical, no matter what compound is used. In acute cases of poisoning in human beings the symptoms are gastro-enteritis, pain and vomiting. In chronic cases of poisoning there is soreness of the mouth, gums and teeth, fetor of the breath; later the gums become swollen, soft, and bleed easily, and still later the teeth become loose, salivation is largely increased, and the tongue and salivary glands become swollen. With larger doses the teeth fall out, ulcers are formed throughout the whole length of the gastro-intestinal tract, especially in the large intestine, and there is necrosis of the jaws, the patient becomes anemic and emaciated and finally dies. Sometimes there is an eruption and ulceration of the skin. In some cases the symptoms are not so marked in the intestinal tract, but are more prominent in the nervous system. The characteristic nervous symptoms are tremors, beginning first in the face then extends to the arms and legs, the palsy following the tremor.

Mercury is very largely used in syphilis but how it acts is not known, but it is thought by some to act by destroying the organism. The constitutional effects are avoided if possible in the treatment of syphilis. Mercury may act if given internally or locally. The following methods are all employed in its administration:

1. Externally in the form of inunction.
2. Internally by the mouth in the form of the sublimate or iodide. Dose 0.001-0.006.
3. Dusted over syphilitic ulcers in the form of calomel.
4. Subcutaneously.
5. Intramuscular.
6. Intravenously (organic compounds only).
7. Fumigation, inhalation or by mercury baths.

Calomel is used as a diuretic where the dropsy is of hepatic or cardiac origin but not where due to kidney disease. How it acts as a diuretic is not known. Mercury is used as a cholagogue, but neither mercuric nor mercurous compounds increase the flow of bile.

IRON. FERRUM, or Iron, is used extensively as a therapeutic agent. This is because it is a normal constituent of the organism, the quantity in an adult being about three grams. It is present in the hemoglobin, and as that maintains the normal process of oxidation, a decrease in the amount of hemoglobin will affect the whole organism. The local and constitutional effects must be carefully differentiated. The former are best seen when soluble salts are applied locally. Iron sulphate and chloride have a characteristic action. In strong solutions they act as caustics, in dilute as astringents. Compounds of iron with albuminous material will have but a slight local action, as their affinity is already satisfied. Baths of mineral water containing small amounts of iron will have no constitutional effect, as it will not be absorbed by the normal skin, and therefore they will act just the same as any bath at the same temperature would.

The affinity of the different iron compounds for albumin is made use of to cauterize ulcers, polypi and chancres, especially the sulphate and chloride. Also in dilute solutions as astringents in inflammation of the mucous membrane of the mouth, rectum, vagina, etc. They are also used as hemostatics combining with the blood and preventing further hemorrhage. Sulphate of iron has been used as a disinfectant of water closets, etc., combining with the ammonium sulphide and preventing further decomposition. For such use large quantities have to be used, in every 100 cubic feet of air requires five kilograms of the sulphate. Crude preparations only should be used.

Iron has an astringent taste, but its insoluble and organic compounds are tasteless, as the taste depends upon the formation of the albuminate. The organic salts, citrate and tartrate, are used for internal administration as their taste is not marked. Iron, like the other heavy metals is transformed into an albuminate before absorption. Both the inorganic and organic compounds are absorbed but the absorption of the inorganic forms is probably slower than that of the organic albuminates as the former have to be transformed into albuminates while the latter have their affinity satisfied before administration. The absorption of iron has been a widely discussed question, many for a long time claiming that iron when given was not absorbed, but that its beneficial action in cases where it was lacking in the system was because it hindered the excretion of the organic iron compounds in the body, thus having just the same effect as though it was absorbed; but this theory has been overthrown by recent elaborate experiments

which prove conclusively that both organic and inorganic iron compounds are absorbed.

Iron compounds are usually given for long periods. Large quantities have marked local effect, therefore in order to avoid this they are given in repeated small doses. If the inorganic compounds are not well borne, one of the compounds with organic acids which have no astringent effect must be used. Iron is given by the mouth in no other constitutional condition except where the amount of hemoglobin is pathologically decreased. The result of the use of iron in anemia is very striking. The headache, neuralgia, disturbance of the gastro-intestinal and other symptoms usually found in this condition are quickly relieved as soon as the hemoglobin rises to normal. Sometimes oedema is present and in such cases the urine becomes increased in quantity and so iron has been spoken of as a diuretic. It acts in this way only by increasing the hemoglobin which is necessary to the proper performance of any of the functions of the body and not by any direct influence on the kidneys.

If injected directly into the circulation it depresses the central nervous system; other symptoms which may be observed are diarrhoea, which may be bloody, and vomiting, these last occurring because of its excretion by the epithelium of the gastro-intestinal tract. If sufficiently large doses are injected death occurs from general paralysis.

U. S. P.

The preparations of iron are

FERRI SULPHAS, or Green Vitriol, large bluish-green crystals, soluble in two parts of water, insoluble in alcohol. Dose 0.030-0.120.

PILULAE FERRI CARBONATIS, or Blaud's Pills, contain sulphate of iron and potassium carbonate. Dose one to two pills. *3 per day*

FERRI CHLORIDUM, yellow crystals, very soluble in water. Prepared from these are

LIQUOR FERRI CHLORIDI, containing 40% of anhydrous chloride. Dose 0.100-0.600.

TINCTURA FERRI CHLORIDI, contains 25% of liquor ferri chloridi. Dose 0.400-2.400.

FERRI CITRAS, red scales, very soluble in water. Is not so irritating as the others. Dose 0.100-0.300.

FERRATIN, an organic iron compound (non-official), supposed to be the form in which iron exists in the liver. It has scarcely any local irritant action. Dose 0.500-1.000. Its constitutional effects are the same as any of the inorganic compounds when absorbed. Some patients take the sulphate just as well as any of the

organic compounds, in which case they are to be preferred from an economical standpoint, as the organic compounds are very expensive.

FERRI OXIDIUM HYDRATUM cum MAGNESIUM is used as an antidote in arsenical poisoning.

ARSENIC AND ANTIMONY GROUP: ACIDUM ARSENICUM, White Arsenic, arsenous acid, occurs in two forms, opaque white masses and transparent crystals, soluble in 15 parts of hot and 80 parts of cold water. Dose 0.001-0.005 and as much as 0.010-0.020 per day.

LIQUOR POTASSII ARSENITIS, or Fowler's Solution, contains 1% of arsenous acid. Dose, 0.100-0.600.

Ferri Arsenas and Sodii Arsenas are more or less identical and have no especial value.

The local action of arsenic must be differentiated from its constitutional effect produced after its absorption into the circulation.

Local action. Dilute solutions of soluble preparations of arsenic produce an exudative inflammation with the formation of blisters. On mucous membranes or ulcerative surfaces the action is more marked and necrosis may follow its application. This caustic effect penetrates to a certain extent into the tissue and is made use of to destroy warts, carcinomatous growths, especially of the nose and lips. Arsenic mixed with charcoal, starch, gum arabic, etc., in the form of a paste has a very caustic effect and when the application is used in proper strength and applied to a cancerous growth it will be changed into a necrotic mass and may be removed as a whole without the use of a knife. The great danger is, that if the application is not sufficiently strong inflammation may set in and the arsenic be absorbed and acute poisoning result. In case a growth has to be removed without the use of a knife use a less dangerous caustic than arsenic such as zinc chloride. Arsenic is used to quite an extent by dentists to destroy the pulp of carious teeth. It has also been used in some countries to destroy superfluous hair.

Internally arsenic causes local irritation of the mouth, stomach and intestine, but this irritation is not very severe because of its rapid absorption. When sufficient has been absorbed the direct symptoms are mainly seen upon the circulatory system. The stomach and intestines become hyperaemic; more blood will be drawn to these abdominal organs and the pressure will fall. This is the only direct symptom observed in man and animals; the central nervous system does not seem to be affected, only the circulatory system.

If 0.100-0.200 of arsenous acid are given there is produced first nausea and tenderness of the abdomen, later pain, vomiting, increased defecation, which later becomes bloody; burning sensation in the throat and intense thirst. The pulse becomes weak and very feeble, skin cold and clammy as a result of the decreased blood pressure, the blood being drawn to the abdominal organs. Shortly before death delirium and convulsions may be seen, but these are not due to its specific action upon the central nervous system but to the decrease of blood pressure. The symptoms and signs of acute arsenical poisoning are nearly identical to chloral poisoning.

Chronic Poisoning. This is produced by the use of arsenic for long periods in small quantities. The symptoms are not so marked upon the intestinal tract. There may be slight tenderness of abdomen, nausea, loss of appetite, mild diarrhoea, later catarrh of the mucous membranes of the nose and eyes and eyelids may become puffy. If the ingestion is continued the metabolism of the different organs are permanently changed, the skin becomes brown and cachectic and ulcers may form, the different glandular structures like spleen, kidney and liver, and the heart muscles undergo fatty degeneration. Still later the muscles, especially the extensors of the hands and feet, becomes atrophied and the peripheral nerves inflamed and as a sequel of this there is an ataxic gait. The patient becomes greatly emaciated and finally may die from impaired metabolism.

When the quantity of arsenic taken is small at first only increased metabolism and formation of adipose tissue is seen and as a result of this there is in cases of anemia an improved look. How this stimulating effect is produced is not known as we do not know whether arsenic circulates as such, or an albuminate. When taken internally arsenic whether in metallic or any other form, has a more or less identical action. Arsenic should be used only in chronic diseases, and not in acute trouble.

As soon as the first symptoms of poisoning appear, that is loss of appetite, catarrh of mouth, nose or eyes, its administration should be stopped.

Arsenic is used in skin diseases like psoriasis, cases of severe primary anemia, anemia due to malaria, and in many chronic nervous diseases. How this beneficial result is brought about has not been explained, but it is probably due to the mild hyperaemia of the gastro-intestinal tract. This mild hyperaemia is not only in the stomach and intestines but also in all the other abdominal organs,

and as a result of it the internal oxidation will be improved and absorption will be quicker than normal. This dilation of the abdominal blood vessels is a constitutional not a local effect, as it follows just as well after subcutaneous injection of arsenic as when given by the mouth.

The rational treatment of poisoning is to remove as much as is possible from the stomach and to transform the rest into an insoluble compound. This is best done by giving freely Ferri Oxidum Hydratum cum Magnesia, which is the official antidote for acute arsenical poisoning. Instead of this the carbonate or sulphide of iron, or even plain magnesia, may be used, as they are all efficient antidotes. A purge should be given after the administration of the antidote in order to remove the insoluble compound.

In chronic poisoning avoid further ingestion, and potassium iodide may be given to increase the excretion, but whether this really increases the elimination or not cannot be judged from clinical reports. Arsenic is excreted to a considerable extent in the urine and to certain extent by the faeces.

ANTIMONY is being used less and less therapeutically. Of the numerous official preparations only two will be given.

ANTIMONII et POTASSII TARTRAS, or Tartar Emetic, colorless transparent crystals, becoming opaque and white on exposure to air, having a sweet and afterwards disagreeable taste. Soluble in 17 parts of water. Dose as an emetic 0.100-0.200 and not more than 0.500.

ANTIMONIUM SULPHURATUM, sometimes called Kermes mineral, is an amorphous white powder, insoluble in water. Dose as an expectorant 0.200-0.600 as a rule dispensed in the form of powders.

Its action is nearly identical with arsenic. Locally as an irritant and caustic, especially the chloride. Its constitutional action is due to absorption into the circulation. Of all the heavy metals only arsenic and antimony produce acute poisoning due to their constitutional effect. Antimony when used internally is not absorbed as quickly as arsenic, therefore its local irritant effect is more marked and vomiting is the first symptom seen. Vomiting is due to its local irritant effect and not to stimulation of the centre of vomiting as is proven by the fact that vomiting is produced quicker if given by the mouth than if given subcutaneously.

After absorption it is excreted by the urine and faeces, and to a certain extent by the bronchial mucous membrane, causing local irritation and increase of bronchial secretion, and as a result of of this action is used as an expectorant. Its practical use is

either to produce vomiting or increased bronchial secretion. Sulphuretted antimony is the best form to use as an expectorant, as it is insoluble in water and therefore slowly absorbed, and its action on the mucous membrane will be prolonged. Tartar Emetic is used to produce vomiting.

Symptoms of acute and chronic poisoning of antimony are nearly identical with the arsenic. Chronic cases are very rare. Its interest is mainly toxicological.

With antimony we will finish our study of the drugs and their special actions. The remaining lectures of the course will be devoted as far as time will permit to the study of General Therapeutics. Special Therapeutics, as well as the indications for the use of special drugs, will be taught in the special clinics and will not be treated of in this course.

T H E R A P E U T I C S .

From our knowledge of the actions and other facts concerning drugs we make use of them as therapeutical agents. The physiological action and chemical composition of many drugs are not well understood, therefore their rational application in disease is impossible. The cause of many diseases is also unknown, therefore even if we did know the physiological action of every drug, in many cases it could not be used rationally. Not knowing the cause of the disease we do not know the action of the drug, and it is only by repeated use in any given disease that we learn that one or another substance is beneficial.

The use of a drug simply because it has proved of value in a disease is termed empirical. This empirical use depends upon the experience of those who have used it in given conditions and found it beneficial. The experience of different men varies, therefore no definite and uniform rule can be given as to the use of any one drug in the majority of cases.

In many cases not only because we do not know the action of the medicine but also because we do not know the cause of many diseases, we are forced to rely upon the result of clinical experience and not upon scientific facts in the application of many drugs. The rational indication for the use of a drug in the different diseases will undergo change as long as we have not the action of every drug in every case. At present our knowledge of the action of many drugs, as well as the cause of disease, is limited. It is only because of our lack of knowledge of chemistry and physiology that therapeutics is so largely an empirical study. At the very moment we have learned these therapeutics will become a rational science. As long as this is impossible so long will we have to deal with therapeutics by the accumulated experience of the clinical results of drugs.

By the use of these clinical results and the few experimentally proven facts an introduction to General Therapeutics will be given. Special Therapeutics will be taught at the bedside of the patient.

In the treatment of disease a correct diagnosis must be made, without this appropriate treatment cannot be given.

In practical therapeutics we treat mainly the diseased organs and not the disease. In a few cases only can we remove the cause

and the removal of the cause does not always mean the cessation of the disease, for example in alcoholic cirrhosis of the liver, we may stop the alcohol but this does not stop the pathological process going on in the liver, the change is permanent. in other cases where the cause is known as in pneumonia, tuberculosis, etc., when micro-organisms have been proved to be the cause we cannot remove the cause and in such cases we have to treat the patient and not the disease directly, but in treating the patient we treat the disease indirectly and assist nature in overcoming the disease. In most cases we try to help indirectly by influencing nutrition, etc., and only in a few cases by treating it indirectly.

According to the method employed the treatment will be either Direct or Indirect.

The direct general treatment against the cause will first be considered. Under this general heading the following sub-divisions will be made.

I. Accessible injured parts of the body.

II. Foreign substances which enter the organism from without. Here the treatment may consist of the removal of the foreign substance or its transformation into a less toxic or non-toxic substance.

III. Directly by local action upon either the diseased organs or products of the disease. The first of these subdivisions is entirely surgical and will be treated in that course.

The treatment of the second, foreign substances which have entered the organism from without, is partly surgical and partly medical. The medical part only will be treated of here. This consists mainly of the treatment of chemical poisons, which is the duty of the physician. The treatment of cases of poisoning will depend as to whether they are Acute or Chronic.

In such cases if the poison is in the stomach the treatment is to remove it as soon as possible. The best way to do this is by the use of the stomach tube, except in those cases where the poison is caustic in action. Under these circumstances there is danger of perforation. If the stomach tube cannot be used, emetics are next indicated, but violent vomiting may cause weakness of the heart and collapse. In those cases where the stomach contained large particles of food the use first of an emetic and then the stomach tube may be preferable. As soon as the stomach is empty, or in those cases where the removal could not be accomplished the treatment should be such as to act upon the drugs so that non-poisonous or insoluble substances be formed and its absorption stopped

or delayed. In the case of arsenic poisoning use freshly prepared ferric hydrate. For alkalies and alkaline earths, dilute solutions of mineral acids. For caustic alkalies use tartaric or citric acid. For corrosive sublimate poisoning, the white of eggs. For oxalic acid, calcium preparations or magnesium.

For many poisons no such special means can be used and in these cases mixing it with colloid substances to prevent absorption for as long as possible must be employed, and an aperient given to hasten its expulsion. As a suitable aperient use some substance of the sodium sulphate group. In case the poison was a gas removal of the patient to fresh air is indicated and artificial respiration may be of some help. In those rare cases where the poison enters subcutaneously, the indication is to prevent its entering the general circulation as far as possible. In bites of poisonous snakes a ligature should be applied above the point of inoculation and means taken to remove or render inert the poison. The wound should be incised and washed with water and permanganate of potassium.

All the different methods of treatment in acute poisoning are to prevent the absorption and entrance into the circulation of the poison. After the poison has entered the circulation it is usually impossible to act upon it directly. In such cases the indication is to hasten its elimination as much as possible by stimulating in every way possible the excretory organs, by drinking large quantities of hot water, injection of normal salt solution, etc. Some poisons are excreted very rapidly, and if life can be prolonged for a short time they may be excreted and the patient saved.

Alkaloid poisoning is treated by giving another alkaloid with the opposite action as far as possible. Very little is known about the action of these so-called antidotes as some antagonize only one or so of the many actions of the alkaloid. The antidotes for the more common alkaloids are as follows,

Atropine antidote is Morphine.

Morphine antidote is Atropine.

Strychnine antidote is Chloral and Chloroform.

Muscarine antidote is Atropine.

The general indication for CHRONIC poisoning are entirely different from those for acute cases. Here the entrance of any more poison should be prevented if possible and only in the second place to increase the elimination of the absorbed poison. The symptoms in chronic poisoning are after effects and cannot be relieved by

acting directly upon the poison. To prevent the increase of symptoms we try to hasten the elimination of the poison present in the system.

The most important forms of chronic poisoning are Mercury, Lead and Arsenic of the inorganic drugs, and Ergot and Nicotine of the organic. To increase the elimination of Mercury and Lead use Potassium Iodide. We do not know how to increase the elimination of Arsenic. Nicotine and ergot are treated simply by preventing further ingestion.

Organized bodies which enter from without and require treatment are tape, round and pin worms. The direct treatment of these is with drugs. In some cases it is very difficult to free the organism of these parasites. Anthelmintics are indicated and their action may be helped by large enema, suppositories and ointments.

Trichinae, after they have left the intestinal canal and entered the tissues cannot be killed by any known drug. Drastics should be given as soon as possible to expel them from the intestinal canal before they have a chance to get into the muscles. Instead of the ordinary drastics large quantities of glycerine are recommended. When intestinal worms have left the intestine and lodged in the body, they are beyond the reach of drugs, although many have been tried, but with negative results. As a rule intestinal parasites are not very harmful; patients may have tapeworm, for years without any inconvenience, while in other cases the gravest symptoms, resembling pernicious anemia, may be due to them. In children nervous symptoms are often prominent, due to intestinal worms.

In intestinal worms the indications are remove them by one of the suitable anthelmintics. Filaria Sanguinis Hominis generally lives in the lymphatics, and is not affected by drugs. Only hygienic measures will improve the symptoms. Skin parasites are very amenable to direct treatment. The free use of soap and water and washed sulphur is sufficient. The direct treatment of micro-organisms has not been advanced at all as yet. Different methods have been tried to accomplish the desired results. The best way would be to have the drug circulating in the system, and thus kill the microbes without harm to the organism. The only disease in which the cause can be destroyed in this way is malaria. It is almost certain that the plasmodia are the cause of malaria. Clinically quinine acts as a specific for it, as under its use the plasmodia disappears from the blood, but there is no proof that it destroys the

microbe that causes malaria. The iodides and mercury are considered specifics for syphilis, but the cause is not known and therefore, as there have been no experiments on the isolated virus, we cannot prove that they act directly.

There are cases observed in practice where malignant tumors diminish considerably in size under the antitoxine of erysipelas, and where inoculation experiments with the virus of syphilis have given immunity to anthrax, but in actual experience the results have not been favorable to this method of treatment.

Serum Therapy, that is the antitoxine treatment, has proved very successful in diphtheria, but in the other infectious diseases has not been very successful as yet. With further investigation and experimentation this method of treatment may prove of great value in other infectious diseases. In order, however, to be successful the experimental results must take place in the actual diseased conditions of clinical practice. These last two methods, the inoculation with a less virulent bacteria in certain conditions and the antitoxine treatment in neutralizing the toxine of a bacteria by the injection of antitoxine, are called Indirect Methods of treatment. It is now generally admitted that antitoxine is indicated in diphtheria.

As soon as the different microbes were demonstrated to be the cause of different diseases the medical world called for disinfectants and disinfections. In laboratories the results with disinfectants were highly successful but when it came to actual practice they amounted to very little. It is easy to destroy the organism by solutions of certain strengths, as for instance, the gonococci are easily destroyed in the test tube, but in spite of the hundreds of attempts in actual cases there is no effective treatment as yet that is generally accepted by the medical profession.

We have learned that under normal conditions of life disinfectants are not needed, so long as proper cleanliness is observed, soap and water being the best disinfectants.

The idea of disinfectants is to kill or render inert the disease-producing germ without injury to the organism; such a disinfectant, however, does not exist. In the choice of a disinfectant the general rule is

I. Do not use a strong disinfectant where a milder one will do. Neglect of this rule has caused many serious accidents.

II. Do not use a disinfectant where it is not necessary.

The use of carbolic acid and corrosive sublimate in the intes-

tine, uterus, etc., has caused many deaths, The excuse of the men who use such heroic treatment is that they have never had an accident, but some day the unexpected will happen. It is impossible to tell when using carbolic acid or corrosive in the intestine, uterus etc., how much will be retained.

The next method of treatment is that of diseased organs and their products. These consist of tumors, stones, exudations, etc. In their treatment astringent and caustic drugs, actual cautery and the knife are used. Malignant tumors, if of suitable size and position, must be removed by surgical operation. Some large stones will also require operation.

Exudations may be serous, fibrinous, purulent, etc. In these cases the indirect treatment by massage, etc., may be tried to assist absorption. If this fails aspiration should be resorted to. In purulent exudations surgical interference will generally be necessary. The general rule is to try indirect methods by influencing the functions of the different organs. How this is done will be treated of later. If the indirect fails, resort to aspiration should be made, but not until after the other has first been tried.

The INDIRECT method of treatment is used in those cases where the cause or the diseased parts cannot be treated directly, the purpose being to counteract the effects produced by the pathological condition. There are three methods of indirect treatment as follows.

1. By influencing the continuity of the parts.
2. By influencing the nutrition of the organ.
3. By influencing the activity of the cells.

The first is surgical and will not be treated of here. The other two are medical.

Nutrition and activity can only be influenced quantitatively, that is increased or lessened. By increasing or improving the nutrition and decreasing the body activity we rest the organism and increases its power. Increase in activity is produced by giving exercise.

THE HEART. The action of the heart depends upon the state of metabolism. If the metabolism is increased the heart has to work harder. The metabolism is markedly increased by mental activity, therefore absolute mental rest is the best way of resting the heart.

After mental rest comes complete bodily rest. This is best at-

tained in the horizontal position where the muscles are relaxed as far as possible and the exertion is reduced to a minimum. In this position the pulse rate is decreased but the blood pressure is held to be higher than when upright, nevertheless it is the best position for rest, as the metabolism is reduced more in it than in any other position.

When compensation of the heart has failed the above is especially true as it prevents any exertion on the part of the patient as far as possible, and lowers the metabolic processes and therefore favors the heart by reducing its work thus improving its nutrition and giving it a chance to hypertrophy and compensate for the additional strain thrown upon it. In some cases where the heart is much hypertrophied, a horizontal position cannot be maintained on account of the pressure of the enlarged heart upon the surrounding nerves and such have to be treated by rest obtained in a sitting position. Rest in bed is indicated in all acute heart complications of a fibrile nature and all acute exacerbations of chronic heart diseases with loss of compensation.

A warm climate not subject to rapid changes is most favorable for patients with heart disease. How high altitudes affect the work of the heart is not known. There is an increase in the pulse rate, but whether the actual work done is increased or not we cannot say, as the amount of work done depends not only upon the pulse rate but also upon the blood pressure. The value of pneumatic cabinets to regulate the pressure of the atmosphere and thus produce artificial pressure is also not known.

Hot baths in general are to be avoided in heart disease, as they may cause untoward results, but in moderation warm baths may prove beneficial, as they decrease the heat production and therefore the metabolism, thus indirectly decreasing the heart's work. Cold baths increase the heart's action by reflex stimulation, and may be used where it is desired to exercise the heart. They are more generally used in those conditions where it is desired to influence the nervous control of the heart. Warm baths should not be used if they cause an increase in the pulse rate, nor in asthma or where the heart's action is irregular. Gymnastics under proper guidance may prove of great value in certain cases.

DIETETIC TREATMENT. It is desired to procure as much rest for the heart as possible by diminishing the metabolism to the lowest possible point. A certain fixed amount of food is necessary to maintain the organism in a healthy state, but any increase beyond

this amount increases the metabolism and therefore the work of the heart. Increased ingestion of food may cause an increase in the weight of the patient and an increase in the metabolism, so it is not desirable to try to increase his weight, but rather to maintain it at an equilibrium, as the patient feels best when getting just enough food to keep up his weight. In a simple uncomplicated heart case it should never be attempted to increase the patient's weight. In order to do this a little experimenting is necessary. The amount of food given the patient should be carefully weighed and measured out. Begin with a small quantity of milk, meat and bread, with a known quantity of liquid for a short space of time. The patient should be weighed from day to day and the amount of proteids increased up to the point where he neither loses nor gains, and when this point is reached enough food is being given to maintain the equilibrium. The liquid taken must be equal always to the amount lost in the urine and by the skin and lungs. This form of treatment is undoubtedly more important than is generally thought.

TREATMENT BY DRUGS. Rest or exercise for the heart should be sought for as needed. Drugs which produce rest do so by diminishing sensory and reflex irritability. Those used for this purpose are the bromides, urethan, paraldehyde, morphine and drugs having a similar action.

To stimulate the heart and give it exercise digitalis, strychnine and caffeine groups are used. The nitrite group by diminishing the peripheral resistance will rest the heart.

Pregnancy always increases the work of the heart and even may cause it to hypertrophy, therefore persons with heart disease if married should avoid pregnancy if possible as it adds additional strain onto an already weak heart.

THE KIDNEYS. The kidneys like all glandular organs are best treated when diseased by relieving them of all unnecessary work; yet there are times when it is best to treat them by increasing their activity. The kidneys are mainly excretory organs, excreting the refuse of all the other organs except the intestine, therefore it is not strange that when they are diseased the whole metabolism should be affected and a variety of symptoms produced. If not treated when diseased, nature may resort to several methods for relief: 1. The kidneys work more if possible. 2. If only one kidney is affected the other may hypertrophy and so compensation be restored especially in children; in adults the heart is more like-

ly to become hypertrophied increasing the blood pressure and forcing more blood through the kidneys. 3. The vicarious function that many of the organs possess, especially the skin, may be brought into play.

In treating them we may in the first place change the quantity and the solids of the urine by regulating the ingestion of food and the exercise of the patient. It is only in rare cases that a decrease in the ingestion of water is made use of and is only indicated in those cases where the quantity excreted is over three or four liters. As a rule it is generally desired to increase the ingestion and excretion of water. This does not hold, however, when the water is retained in the system, as in ascites, etc. In those cases where an increase of diuresis is desired and where the heart is strong some of the diuretics, as potassium acetate, caffeine and theobromine are used. The use of these must be governed by their effect; if they increase the irritation of the kidney we must stop their use and fall back on the vicarious function of the skin and bowels. Normally 600 c.c. of water are excreted per day by the skin, containing a certain amount of the different solids constituents of the urine. In the course of a kidney disease these solids are increased and to such an extent sometimes that the body may have a slight urinary smell, and crystals may be deposited upon the skin by the evaporation of the sweat. To increase sweating, and so the excretion by this means, the following are used:

The warm bath at 40°C. or the Turkish bath, after which the patient should be put in a warm bed and given hot drinks. If hot water baths are not well borne, hot air baths may be tried. Under such treatment the amount of sweat excreted may rise from the normal 600 c.c. up to 1200-1600, and this may be further increased by the use of pilocarpine. The objection to them is that if used for long periods hot baths are liable to weaken the patient.

To encourage the vicarious functions of the intestinal tract aperients of the sodium sulphate group and the Vegetable Drastics as scammony jalap and gamboge are used.

They do not stimulate the kidneys but cause watery stools and so increase the excretion of the water. In case the oedema or ascites does not disappear by the use of diuretics or aperients, resource must be made to mechanical means for the removal of the fluid. If it is in serous cavities, as in ascites it may be removed by aspiration or if in the skin by scarification or the introduction of a trocar.

Digitalis strophanthus and scilla may be used to strengthen the heart's action and improve the circulation. A weak heart and pulse are indications for the use of a heart stimulant.

If the oedema still persists in the extremities, pressure either continuous or intermittent, is to be used in the form of bandages or massage.

The TREATMENT of KIDNEY DISEASE has undergone a great change. Formerly it was considered best to treat by exercising the kidneys and so increased amounts of proteids were given as they increased the nitrogenous excretion. This was manifestly wrong as the excretory power of the kidney was already impaired, it was throwing more work on a diseased organ instead of lessening it. Now we decrease the ingestion of proteids as far as possible.

How far we can reduce the proteids without impairing the organism is not definitely known, but we do know that with from 60-70 grams per day the body weight can usually be retained. The best form of proteid is that of milk, but a pure milk diet is hard to maintain for any length of time, as the patient gets tired of it and rebels, but in all acute cases a strict milk diet should be ordered and maintained until the acute symptoms subside. When this stage has passed, proteids in the form of eggs and milk may be given. The question of what kind of meat, whether light or dark, is of little consequence; the important consideration is the quantity and not the quality. Carbohydrates and fats are not to be restricted, as the proteids are diminished, and we wish to increase the weight of the patient if possible, therefore an increase in these is indicated. All vegetables containing volatile oils, such as asparagus, parsley, etc., are contraindicated, as they irritate the kidneys.* At one time it was thought best to reduce the salts of the food and thus reduce the amount excreted. This should always be done by reducing the amount in the food and not by giving distilled water, as was suggested by some, for we have already seen that distilled water is harmful to the organism. Spring water or milk is the best drink.

Climate. A warm climate is preferable, as heat production and body metabolism is decreased.

Exercise. A moderate amount is absolutely necessary. Only in acute inflammnatory conditions is absolute rest in bed indicated. In all other conditions a certain amount of exercise is beneficial, as it aids digestion and tends to improve the general health. Walking is the best form of exercise.

MEDICINAL TREATMENT. Many drugs have been tried but without

very satisfactory results, although we have quite a number which act directly on the kidneys. It is best to use as few drugs and in as small amounts as possible. The best treatment is dietetic, meeting complications as they arise by the method indicated.

LUNG DISEASES. The motor impulses to the respiratory muscles are sent out from the respiratory centre which controls respiration therefore the increase or decrease in respiration will depend on the condition of this centre. The blood exerts a direct influence upon this centre making it more or less active according to its increased or lessened need for oxygen. If it contains much carbon di-oxide it stimulates this centre strongly and as a result impulses are sent out which stimulate the respiratory muscles and cause an increase in the respirations thus supplying the need of blood for more oxygen. If the blood is well oxygenated no stimulation is produced and the respiration remains quiet. Anything which interferes with the respiration or circulation must tend to disease of the lungs.

The agents affecting the movements of the lungs are:

(a) The striped muscles controlled by the respiratory centre, (b) the elastic fibres, (c) the smooth muscular fibres. The condition of the chest wall (elasticity, etc.), and the condition of the living membranes may also influence these movements.

Since respiration must continue as long as life lasts we cannot treat the lungs by absolute rest but must do as with the heart, by giving it as much PHYSIOLOGICAL rest as possible. In those cases where the respiration is increased the indication is to reduce it and thereby remove or relieve the pain which is usually present in such conditions. Several factors come into play in producing this reduction, the first being

Position of the body. When standing up a greater amount of air enters the lungs than in any other position. When sitting up the conditions are practically the same as when standing. Less air enters in the horizontal position, hence when the respiration needs to be quieted a horizontal position is indicated. If on the other hand the patient is troubled with dyspnoea and the lungs are working harder on this account an upright position is indicated. If the patient is in his right mind he will attend to this himself but if he is unconscious it will be necessary to place him in a proper position either sitting up or bolstered up and thus produce the position that he would naturally take if conscious. Any sort of body movement increases the respiration therefore to decrease it absolute body rest is indicated. Patients with dyspnoea are gen-

erally restless and their reflex activity is usually increased. In those cases where the respiration is unduly increased and the patient restless in order to lessen the movement and produce the necessary rest a narcotic may be used. Morphine in small doses will lessen the reflex irritability and produce quiet rest.

When rest is desired, talking must be prohibited, as it increases the dyspnoea and metabolism and sets up increased muscular activity by the movements necessary to talking. Breathing in air rich in oxygen will decrease the respiration and assist in relieving dyspnoea, but it is available only in rare cases and for short periods. The plan for resting a limited part of the lung by bandaging and then preventing the muscles from acting and that portion of the chest wall from expanding has been tried. The bandaged part works less than the free part and so gets rest. This treatment has also been tried in cases where the apex was diseased. Tight bandaging of the affected part served to relieve the pains and ease the respiration. The fact that there are fewer cases of diseased apices in women than in men is said to be due to the fact that the wearing of corsets makes the apices more active in women than men and so less liable to pathological changes.

The elastic fibres of the lungs are necessary to the maintenance of their normal condition. Whether we can influence these or not cannot be definitely stated, as the results are contradictory so far. We only know that they must be kept in a good condition if respiration is to be properly carried on. Emphysematous conditions have been treated by the use of the pneumatic cabinet and other apparatus which regulate the moisture, pressure, etc., but the results have been variable, so that we cannot say when such treatment is indicated. It is certain, however, in such conditions that forced expiration is as necessary as deep inspiration, since it tends to help the contraction which is weakened.

Effect of altitude. In higher altitudes we deal with rarefied air, but this property does not account for all the results seen. The air is not only rarer but it is also purer, and having fewer microbes is less dangerous to an affected lung. The air being rarer, more of it is necessary, and so the inspirations are prolonged while the expirations are shortened, hence the circulation, metabolism and heart's action are increased. A stay in high altitudes therefore increases the work of the lungs. Whether such an increase is indicated depends upon no general rule, but upon each case in question. If the patient is strong and robust it may be best, but a trial may show that the results are unfavorable, and

what may prove of value in one case may have the opposite results in an apparently similar case. The question of altitude therefore will have to be judged for each case separately according to our best judgment of all the facts we possess.

Effect of Stimulation of the Skin. The skin normally absorbs a small amount of oxygen and excretes about 1% of the carbon dioxide thrown off by the body. The skin therefore cannot be made to take the place of the lungs, but may aid them indirectly. Cold douches and application stimulate the skin and cause an increase of the respiration and improve the circulation and may be of value, especially in fevers where the respiration is shallow. Ice applied locally acts as an anesthetic and may be of use where pain is causing a decreased respiration.

Treatment of Mucous Membranes of Respiratory Tract. Here pure air is the prime requirement; air containing any irritating substance should be avoided. For this high altitude, sea air and especially avoidance of towns and cities, is best. Part of the dust and solid particles in the air may be kept out by breathing through the nose. This protects the mucous membranes of the lungs and bronchi and so if there is anything which obstructs the nose and prevents or hinders nose breathing it should be treated at once.

Temperature of the air is of no importance except that in warm climates where the air is warm the windows may be kept open and good ventilation assured so that the patient will be enabled to breathe fresh air night and day. Dry air absorbs moisture and so tends to dry up the secretions of the bronchial mucous membranes and make the expectoration more difficult, hence moist air is better. This applies only to the upper air passages for before reaching the smaller bronchi the air has always become moistened.

MEDICINAL TREATMENT. Creosote, guaiacol and some of the other disinfectants are used to a certain extent in the treatment of phthisis as it is claimed they lessen the sputum and disinfect the respiratory tract but their use is not rational.

Expectorants are to be used when it is desired to increase the secretion or to make the expectoration more free. They are the alkalies, members of the sodium chloride group especially ammonium chloride, vegetable expectorants such as senega and the emetics in small doses. Pilocarpine in small doses may be used in acute processes such as acute bronchitis.

Narcotics are indicated when there is excessive secretions or violent cough. To decrease bronchial secretion or the night sweats which are often very troublesome, atropine or agaricin are

used. The opiates are used to relieve cough and also to decrease the bronchial secretion. Any local cause of cough, as the throat or pharynx, may be treated by the proper local remedies. The nose may be treated by the inhaling or spraying of antiseptic and disinfectant solutions. These latter are often the cause of a prolonged cough and should always be carefully looked after.

Dietetic Treatment. Scientifically there is no lung diet, as it is not known whether the action of the lungs can be affected at all by diet. The indications are for the diet that will keep the patient in the best possible condition; especially is this true of phthisical patients. The proteids should not be increased nor yet diminished. Increase of these does not increase the body weight but merely increases the destruction of nitrogenous substances in the body. A certain amount of fats and carbohydrates may be added to the normal, but the fat cannot be increased beyond a certain point, which, however, varies much in different patients, as it causes digestive disorders. To prevent body consumption an increased mixed diet in general is indicated, and not certain portions of it. Do not increase the proteids, but increase the carbohydrates and fats. A rich adipose layer saves heat dissipation to a certain extent.

Climate. Tuberculosis may be treated in any climate where the variations are not too extreme. Low temperature and high altitudes are best for those cases where it is desired to increase the metabolism. Low altitudes and warm climates are better for those who are weak and whose interest requires reduction of body metabolism. This, however, cannot be regarded as a fixed rule but only a general indication, as each case must be a law unto itself.

DISEASES OF THE ALIMENTARY TRACT. In diseases of the alimentary tract rest for long periods cannot be obtained, since digestion and absorption must go on if life is to be prolonged, hence in treatment of diseases of this tract we must resort to diet, the importance of which is very great. In the middle of this century no attempt to regulate diet was made because practically nothing was known in regard to the process of digestion or even the diagnosis of diseases of this tract. Of late years, however, much has been learned along these lines. To maintain life in a normal condition a diet consisting of proteids, fats and carbohydrates is necessary.

Process of Digestion. In the mouth, under the influence of the saliva, starch is transformed into dextrine and later sugar. Just what part of the saliva has this action is not known. This process

is continued for a short time after the food has entered the stomach. The more food is masticated the better is the saliva mixed with it and the better can this action go on. Acids stimulate the secretion of the salivary glands, therefore when the saliva is diminished acids are used to increase the flow. Thorough mastication of the food is of great importance, as it not only causes the saliva to be mixed with it better and thus aids its action, but it also puts the food in better condition to be acted upon by the other digestive juices.

As soon as the food enters the stomach the gastric juice begins to be poured out, and as soon as the alkalinity of the mass is overcome digestion of the proteids begins. The gastric glands are stimulated by alkalies so that the saliva has another action besides its action on the starches, for being alkaline in reaction it stimulates the flow of gastric juice. Whatever tends to prevent or lessen the saliva entering the stomach interferes or hinders gastric digestion. Proteids and gelatinous materials are acted upon by the gastric juice and transformed into peptones and albumoses. Starches and fats are not acted upon by it but the proteid envelope of the fat drop is digested away and if the fat melts at 37°C. or less it may run together and act as an irritant to the mucous membranes; hence when the membranes are irritable or inflamed fats should be restricted or omitted from the diet as they may intensify the inflammation, or in some cases where the stomach is irritable even the introduction of food may be sufficient to cause vomiting.

Mechanical stimulation of the stomach may stop secretion and sometimes produce vomiting.

During the secretion of the gastric juice the mucous membrane is red and congested, and if stimulation is applied at this time it may drive the blood away, the membrane becoming pale and the gastric secretion lessened, while the secretion of mucus is increased and as a result vomiting may be produced. Cold drinks decrease the gastric secretion and retard digestion. Too hot ones have the same action but moderately warm ones increase it and help digestion and because of this action a glass of warm water before meals has a beneficial action in many cases and is frequently ordered for patients with gastric trouble to be taken soon after rising in the morning.

The gastric juice also acts as an antiseptic, killing or rendering inert many bacteria which may be taken in with the food. It also by this action prevents decomposition by killing the bacteria which cause putrification of meat, but it does not affect

those bacteria which decompose carbohydrates or cause lactic or butyric acid fermentation, but allows them to pass into the intestine unharmed.

The gastric juice has a two-fold duty:

1. As a digestive fluid.
2. To prevent putrefactive decomposition.

Absorption from the stomach. The empty stomach does not absorb cold water. From soda water only the carbon dioxide is absorbed. Alcohol is readily absorbed; also grape, cane, milk, sugar, and maltose from alcoholic or watery solution. Dextrine and peptones are less readily absorbed than sugar.

The quantity of the substance absorbed is in direct proportion to the concentration; the more concentrated the solution the greater the absorption. While these are being absorbed from the stomach there is also an excretion of water going on into the stomach, which may be found going on even when pepsin or hydrochloric acid cannot be detected. If there is stenosis of the pyloric orifice the food of course has trouble in passing out, and dilation of the stomach often results. In these cases nutrient matter is being absorbed from the stomach and abdomen at the same time water is being excreted into it, sometimes in larger amounts than what is absorbed from it, and as this cannot pass on owing to the stricture, it may accumulate to such an extent that a much larger quantity of vomitus is thrown off by the patient in some of the cases than the total amount of food ingested. This excretion of water into the stomach was not known till lately, so that it was puzzling often to account for the excess of water thrown off in these cases.

In dilated conditions of the stomach if the pylorus is obstructed removal of the contents of the stomach by the use of the tube is indicated after the absorption of the nutrient material has taken place. Absorption from the stomach is quite rapid, part of the contents may be found to be absorbed in fifteen minutes after ingestion.

Secretion of Pepsin. In the great majority of cases where pepsin is thought to be lacking, pepsinogen is present in sufficient quantities but pepsin is deficient because of the inability to transform the pepsinogen into pepsin, due to the lack of hydrochloric acid. In such cases hydrochloric acid is indicated and not pepsin. There are, however, some cases where pepsin is actually wanting, and in such cases it should be given in large quantities and not in the small doses usually given. Some bacteria grow in acid medium and so are not killed by the gastric juice.

If present they may be killed by some disinfectant as carbolic acid or washed out by the use of the stomach tube.

Emptying of the Stomach. This process begins in about fifteen minutes. Rhythmical openings of the pylorus allows the fluid contents to escape into the duodenum and if the meals were very liquid the process begins sooner. The first part of the meal may reach the illeo caecal valve in about two hours and the last in from thirteen to fifteen hours. As soon as the acid gastric contents reach the stomach the alkaline fluid which are poured out into it begin to act. They are the succus entericus, bile and pancreatic juice. In the intestine the digestion of the proteids, fats and carbohydrates goes on and from here 90% of the absorption takes place. All the different juices are increased during the process of digestion.

Bile is the only effective chologogue, although many drugs are usually thought to have this action. Bile and bile only can increase the flow of bile. Nothing is known which will increase the flow of the pancreatic juice although it has lately been thought, and late experience seems to indicate that pancreatin will increase it. This as well as pepsin should be used in large quantities when indicated, and should be given in the form of the enteric pill coated with salol or glutol (produced by the action of formaldehyde on gelatin) so that it will not be acted on in the stomach but reach the intestine unchanged.

Alkaline fluid is secreted throughout the whole intestinal canal, but it is more alkaline at the lower end. In spite of this fact the contents of the intestine are acid, owing to the presence of organic acids (butyric, acetic and lactic) formed by the action of bacteria on carbohydrate matter. Besides these acids carbon dioxide and several other gases are present.

In the normal contents of the small intestine there is no putrefaction due to the action of saprophylic bacteria on proteids, not every lucin or tyrosin being present. These contents of the intestine are normally acid in reaction, due to the decomposition of the carbohydrate material into organic acids; this therefore prevents the action of these bacteria which can only act in alkaline media. This is a good reason for the use of a mixed diet, even were there no others. All the decomposition products of the intestine are formed in the colon where the reaction becomes alkaline.

In spite of diminished gastric secretion, and even after extir-

pation of the stomach, the intestinal digestion may meet all demands of the system, and the patient may even gain in weight. This vicarious function of course is not available where food cannot reach the small intestine, as in cases where there is stenosis or blocking of the pylorus from any cause. In cases where there is carcinoma of the stomach, there finally comes a time when nitrogenous equilibrium cannot be maintained. When this occurs we must protect as far as possible the proteid matter of the body by increasing the carbohydrates and fats of the diet. Food may be administered by the rectum, experiments showing that water, sugar, pepper and uncoagulated proteids are absorbed from the lower bowels. Thirty to forty grams of albumen, or the equivalent of five raw eggs may be thus absorbed in twelve hours and about eighty grams of peptone in about the same length of time. Sodium chloride aids materially in the absorption. If there are ulcers in the large intestine decomposition products may be absorbed, and in such cases the bowels should be disinfected by mild disinfectants or large enemata of water.

Quantity of Food necessary to keep the body in its normal condition. The ordinary working man of 70-75 kilo weight if he can get food to his liking takes 50-200 grams of fat, 300-800 grams of carbohydrate and 120-150 grams of proteids per day. They may however maintain their nitrogen equilibrium by taking only 100 grams of proteids, 50 grams of fat and 500 grams of carbohydrates per day. Women need about one-fifth less.

To a certain extent one food stuff may replace another, but about 60 grams per day of proteids seem necessary. Above this amount the difference may be made up by an increase of fats and carbohydrates, but this amount of proteids seems necessary in order to maintain a normal condition. Fat may not be decreased without limit, without corresponding loss of weight. The best proportion to observe in diet is one part of fat, two parts of proteids and ten parts carbohydrates. This maintains life without overtaxing the alimentary canal and seems to be about the best proportions for our race.

In the Dietetic Treatment of diseases of the alimentary tract, we must differentiate between acute cases, acute exacerbations of chronic cases and chronic diseases.

Acute Cases. In these absolute rest of the tract is indicated, and mouth-feeding may be replaced by rectal feeding for two or three weeks. This does not produce entire rest, because the reflex

action produced by the presence of food in the bowels causes secretion to go on, and if drugs are given they may be excreted into the stomach; hence absolute rest is impossible. There may be a loss of weight as a result of this method of treatment, but this is more than counterbalanced by the improved condition, and weight is rapidly regained when it is possible to return to an ordinary diet.

Chronic Cases. Feeding in chronic cases must be by the usual method, and each case must be treated according to its own special needs. The patient is getting a sufficient quantity of food if he is holding his weight or having lost is beginning to gain. Each article of food is to be chosen according to the circumstances, nature of the disease, etc. A diet consisting of only one kind of food should not be kept up too long. Proteids in sufficient quantities can usually be given in the ordinary articles of food. Too little fat is often given in gastric troubles. This may be overcome by using fresh milk, butter, etc., in larger quantities. To alleviate pain, overcome or prevent anorexia medicines must be used. For pains, morphine, chloral and cocaine are used. For nervous gastric pain the bromides are very useful. To decrease peristaltic movements morphine or opium is necessary, especially in cases where there is hemorrhage from ulcers, etc.

In cases where ulcers are present subnitrate of bismuth or large doses of chalk are good to prevent the gastric juice from acting on them and irritating them. Cases of ordinary diarrhoea may be checked when it is desired to do so by the use of the simple astringent. The stomach and intestines may be disinfected by the use of drugs. Saline aperients are about the best disinfectants as they empty the bowels and remove the cause.

Absorption is increased and mucus dissolved and removed by the use of salines. To overcome anorexia use one of the bitters as gentian, columba, quassia, taraxacum, etc. In some of these cases forced feeding at regular intervals is resorted to, especially is this method valuable in cases of nervous anorexia. Tube feeding should however never be resorted to in cases of organic disease.

Electricity, massage, cold and warm baths are other methods of treatment resorted to. Massage may prove of great value in cases of constipation and dilated stomach. In the latter cases the pylorus must be located so that the food may be urged along in the proper direction. No especial indications for the use of electricity can be given. High altitudes and cold climates may be tried for strong patients and the opposite for those who are weak.

Chronic alimentary troubles can only be improved by improvement of the general condition, as this improves so will the other. Without the necessary quantity of proper food no success can be expected from any treatment.

METHODS USED IN THE TREATMENT OF SKIN AND MUSCLE. In the consideration of the treatment of the lungs we came to the conclusion that a certain amount of work was absolutely necessary to keep them in a good condition, and this cannot be diminished without injury to the lung and the whole constitution. The same fact is true of the muscular system.

By absolute body rest we get physiological rest, but by body rest we can only reduce quantitatively the rest of the muscle. There are chemical processes constantly going on in the resting muscle and the resultant formation of carbon dioxide. In order to preserve the nutrition of muscles, muscular action is necessary, and if this is inhibited they will decrease in size and strength and atrophy will be the ultimate result. Rest for muscles may be provided by enforcing body rest and by the use of bandages, splints, etc. Exercise may be given to muscles in two ways:

1. Direct, by motions or movements.
2. Indirect, by use of electricity and massage.

The direct method is dependent upon the will of the patient, while the indirect is independent of his volition.

The direct method includes walking, riding, skating, etc., as well as prescribed muscular movements, as chest weights, dumbbells, etc. Where the exercise is prescribed, as in gymnastics, it must be carefully regulated. The best form for this is the Swedish system, where a graduated scale is in use and the actual resistance to be overcome is measured.

Where the will cannot be made use of electricity and massage must be resorted to. The Faradic current is usually employed and as long as the muscles and nerves respond to stimulation it seems of no importance as to which it stimulates. Even in the cases where the muscle fails to react to the current it may be of some benefit, as the nutrition of the muscle becomes influenced by the chemical processes which go on in it. Whether this is due to the action of the electric current on the chemical processes in the muscles or to its action on the blood vessels, is not known. In those cases where the muscle fails to react to the electricity the Galvanic current is as good as Faradic.

Treatment by Massage acts by mechanical means. It increases the circulation and metabolism of the muscle, and is especially suitable in cases of atrophy and contraction of muscles. Acute muscular rheumatism and simple sprains may be very much benefited by massage. Formerly rest was the treatment for sprains, but now massage is used with better results than under the old rest method. Massage should be learned by every physician as it may give excellent results in some cases where the use of drugs for months has failed to do any good.

Another method of the treatment of muscle is by bathing. According to the temperature of the bath the results will vary. Hot baths decrease, while cold baths increase the heat dissipation, and thus either rest or exercise may be produced, but only to a limited degree, but this to a large degree is dependent upon the nervous system. Warm baths act as sedatives, while cold baths stimulate but in cases where the nervous system is excitable the reverse may be true, warm baths acting as stimulants. This can only be learned by experience in each case.

Whether Diet affects the muscle or not is not known. The condition produced in training for athletic sports where a certain diet is adhered to is but for a short time while the result we seek is the permanent improvement.

MEDICINAL TREATMENT. This is not intended for permanent use but only to be kept up for a short space of time. Drugs which could be used are first physostigmine, which stimulates all the striped and unstriped muscular tissue. It is sometimes used in small doses in atony of the intestine, to make it contract. To act upon the skeletal muscles much larger doses are required, so that they could not be given with safety. Other drugs which are used are strychnine and caffeine. Caffeine may act directly upon muscular tissue while strychnine acts only through the nerves.

In the treatment of the skin the function of the epidermis must be considered. Normally it acts as a protective to the whole organism, as a heat radiator, by increasing or decreasing the excretion of sweat. The skin must be kept clean in order to keep it in good condition, especially in warm climates, as here it is very active, and upon its activity depends the health of the person. In cold climates washing of the skin is of less importance. In arctic regions water is but little used for the sake of cleanliness. Soft water and neutral soaps are best to cleanse the skin

without undue stimulation. Hard water and the salts of mineral water act as stimulants to the skin, and on this account are used in many chronic skin diseases. Only in acute skin diseases do we avoid the use of water according to the teaching of modern dermatologists. Delicate skins may be irritated by ordinary soaps, and for such cases soaps containing an excess of fat should be used. These have an acid reaction from the excess of fatty acids and should be used where stimulation is to be avoided and where the skin is dry and does not contain much fat. Alkaline soaps are useful where the skin is rather fatty and where stimulation is desired, as in chronic eczema and psoriasis.

The method of living has great influence on the skin. Where the weather is changeable the skin becomes reddish, mainly due to the sudden changes of temperature, while in moderately warm climates it is of a whitish color. Light as well as temperature affects the skin. This has been demonstrated of late years by the X-Ray dermatitis and burns. Not only is the normal skin but also pathological conditions influenced by light. Especially is this true of smallpox and scarlet fever, where the patients do better and the eruption and its sequelae are less marked if they are kept in a dark or shaded room.

What influence diet has upon the skin is not known but it is known that in certain patients certain food such as strawberries, smoked fish, cheese, etc., will cause rashes and eczema. What causes this is not known but it seems to depend greatly upon what is known as the person's idiosyncrasy. Whether the skin can be influenced by special diet is not definitely known.

The most logical dietetic treatment of chronic eruptions is a simple diet without any condiment except salt. Changes may then be made in it, watching meanwhile the changes produced by the diet. There is a great difference of opinion among dermatologists as to the proper dietetic treatment, some taking exactly the opposite position to others.

Formerly the treatment of skin diseases was by what were known as "blood purifiers," but this has been abandoned now except in rare cases, local treatment being used almost entirely.

Normal function of the alimentary canal is necessary in the treatment of the skin. Constipation, fermentation, etc., if present must be treated first before the skin can be successfully treated. Often skin diseases occur as a result of constitutional diseases, as diabetes, myxoedema, etc., and if these are cured the

secondary skin trouble will also be cured. Here only the skin diseases pure and simple are considered, not when they appear as sequelae to other conditions.

Water is excreted by the skin, lungs and kidneys. The amount thus excreted by the lungs depends upon the condition of the air, and that by the kidneys upon the state of the blood. The excretion by the skin is more under our control and can be altered considerably by the amount of exercise, temperature and the amount of water ingested. Under ordinary circumstances the body loses 2500 c.c. of water daily (urine 1500 c.c., respiration 400 c.c. and perspiration 600). This loss has to be made up from day to day. The amount of water ingested generally depends upon the thirst which under normal circumstances regulates the necessary amount of water, but under certain circumstances this regulation fails and the physician must give enough to make up this deficiency. The amount needed can be told from the quantity and specific gravity of the urine.

Another method of regulating heat is by clothing, which should be of such a kind as not to interfere with the perspiration. To lessen the loss of heat to a minimum we must decrease the perspiration as much as possible, as the quantity lost by perspiration is much greater than is usually thought. Loss of heat is prevented first by clothing, made of cotton, linen, silk and wool. Radiation is greatest from linen, next cotton, then silk, and lastly wool. The color of the material is also an important factor, black having the greatest conductivity, then green, red and white. Clothing of white wool is indicated in cold climates when it is desired to prevent dissipation. In hot countries white wool clothing is also best because it prevents conduction of heat from without and interferes less with the perspiration than that made from any other material. Wool stimulates the skin and delicate skins cannot stand the stimulation, so that is often necessary to mix it with one of the other less irritating materials, such as cotton.

The sweat may be influenced by certain Drugs. Atropine and agaricin decrease it while pilocarpine increases it. When the sweating is increased locally, as in the hands, feet, axilla, etc., an astringent preparation is used.

The skin is treated medicinally either by drugs given internally to bring about a cure by constitutional effect, or by the local application of antiseptics, caustics and astringents. When treated by internal medication arsenic is the drug generally used. Local treatment is used in the vast majority of cases. Besides

antiseptics and astringents in such case drugs which act simply by mechanical means as protectives are also used. The general rule for local treatment is to use in acute cases drugs which act by preventing inflammation and provide rest to the skin, and in chronic cases drugs which stimulate the skin. The drugs used in the treatment of the skin diseases will be treated of more at length in special clinics.

NERVOUS SYSTEM. The different methods of treatment here are principally the same as with other organs; that is, increase or decrease the activity. Their consideration in general therapeutics is much more difficult than the therapeutics of other organs. In criticizing the different methods we encounter great difficulty. No organ is so much under the influence of the will as the nervous system. The psychical centres have great influence and is quite impossible to say in a given case whether we are acting on the nerves or through psychical influence. This may explain the observation so often made where in apparently identical diseases the same method proved to be a curative factor in one and in the other case, when used for months, produced no help whatever, because it did not have the same psychical effect. Another factor which increases the difficulty of treating the nervous system is the close connection of each nerve with the whole nervous system. If one nerve is acted upon, the whole nervous system is influenced by reflex action and the final results will be brought about through the action of the whole nervous system, even if only one single nerve is acted upon.

The following different methods will be considered: I. Treatment of the Sensory Nerves. II. The different methods used to influence the Motor Nerves. III. Therapeutics of the Central Nervous System.

Nearly all of the different methods used as a sedative measure in the treatment of the skin may be used for the same purpose in the treatment of the sensory nerves; on the other hand all the methods which stimulate the skin will also stimulate the sensory nerves. Warm bath and moderate climate rest the sensory nerves. Temperature of bath to act as a sedative must be a few degrees below the body temperature. The changing calibre of the blood vessels is continually kept up by the constant action of the sensory nerves and the vaso-constrictors and dilators.

This constant action will be stopped during the warm bath, as it will dilate the blood vessels and the regulation will be unnecessary. Very high or very low temperature act as stimulants to the metabolism and sensory nerves. To help the sedative effects of a

warm bath the person should rest at least one hour after bath. Instead of the warm bath the wet pack may be used. Bathing in salt water, different mineral springs and various forms of cold douches are used as stimulants to the sensory nerves.

Another method used to stimulate the sensory nerves is Electricity and for this purpose the Faradic current is used. In applying electricity to a nerve, the whole nervous system is influenced. Its action is very complex as it acts upon all kinds of nerves and the results are different according to the function of the nerve, as pain with sensory nerves, motion with motor nerves, etc. It brings about a condition which is called electrotonus. How this may influence therapeutic measures is not known.

Electricity also acts by chemical changes upon the chemical constituents of the body. Alkali constituents tend to go to the negative pole while the acid elements are attracted by the positive pole. In the neighborhood of the pole a decomposition takes place with the liberation of acids and alkalies and may bring about ulcerative processes at the point of application of the poles. This is a complicated effect. The complex action upon the organism makes the rational application difficult and may explain the different opinions which physicians have regarding its use as a therapeutic agent.

In the electrical treatment the Faradic current is mostly used. Sometimes the constant current is used. Erb is the recognized authority in electrical treatment. In neuritis he applies the anode to the diseased part, and the cathode to the more central part of the same nerve or corresponding part of the spinal cord. In Chronic Troubles he advises putting the cathode upon the diseased part or to alternate between anode and cathode.

Electricity may be used in the form of an Electric Bath. Specialists in this line now say that electricity should be used only in recent and not in chronic cases.

Drugs which may be used as local sedatives to the sensory nerves are cocaine and its allies, although it is thought by some that morphine, atropine, chloral and gelsemine may act as local anesthetics, but this is not definitely settled. Some physicians deny local effect of these preparations and say cocaine is the only one which may act locally.

Among other methods which may act as local sedatives, Pressure and Cold must be mentioned. With a certain amount of pressure upon sensitive nerves the pain may disappear, and the same may be produced by the application of cold in the form of ice or ether spray.

In making a subcutaneous injection of morphine in the case of pain some physicians think morphine acts not only by its special effect but also by the local pressure caused.

Another method of treating the sensory nerves is the local application of substances belonging to the three classes of skin irritants. The curative effect is caused by stimulation and reflex action and counter irritation is produced with the hope of curing the affection of the sensory nerves; instead of drugs the actual cautery may be used as a counter irritant.

In acupuncture a steel needle about two or three inches long is thrust into the affected part with the hope that the inflammatory process set up in the nerves may be a cure. Great relief sometimes may be brought about by this method in lumbago, rheumatism, etc.

MOTOR NERVES. Any method or treatment which stimulates muscles will stimulate the corresponding nerves, and such methods which act as sedatives to muscle will also act as sedatives to nerves. Electricity may be used to stimulate muscle, but if the nerve is degenerated it is of no value. Pressure in the form of massage may be useful in some cases.

DRUGS. Curare is used for paralyzing purposes with good results. Nerves to the unstriated muscle of the intestine are paralyzed by atropine and stimulated by physostigmine and nicotine, causing increased peristalsis. The treatment of the spinal cord is the same as for the sensory or motor nerves.

Very often all the different methods will be without any effect, as for example, locomotor ataxia. Erb thinks electricity is good in Tabes Dorsalis and advocates its use. A large number of drugs are used in the treatment of diseases of the spinal cord, but they are all used empirically, as nothing is known in regard to their rational use.

BRAIN. The best method to rest the brain is sleep, and all stimulating effects which may act upon body or brain must be withheld. Attention to minute details may be followed with good results in extreme sleeplessness. The last meal before retiring should be light and no heavy exercise or brain work should be indulged in. Everything in the room should be quiet and at rest. All the sedatives to the skin will help to produce sleep, as the warm bath, wet pack, etc. Attention should be paid to minute details first. Of the drugs, one of the many hypnotics may be used, and knowing their relative value and danger we must always choose

the most suitable preparation in every case. In those cases in which sleep must be procured quickly, one of the anesthetics, as ether or chloroform, must be used. No matter by what drugs sleep is produced, they should never be used indefinitely. The aim of therapeutics must be to discard drugs as soon as possible.

Besides drugs Hypnotism may be used and ought to be tried in suitable cases, after other methods have first been tried. Suitable cases are those of sleeplessness in hysterical patients. Here psychical effects play the prominent part. Until we understand better the condition and nature of hypnosis we must consider it as due to psychical effect. The patient may be influenced by the personality of the physician, and the success of many physicians is due to this influence.

Christian Science and other methods in which the patient is influenced by suggestion may all get beneficial results where psychical effects are capable of producing a cure and cases where absolutely worthless and not even active drugs were used have been benefited simply by the mental effect they have produced.

Electricity is another method. The galvanic current is used for the head. A weak current must be used in the beginning of such a treatment as is it impossible to predict the results, and unconsciousness may be caused by a single treatment. In treating the head it is applied for a much shorter period than in the treatment of other parts; only two or three minutes for the head, but for sensory or motor nerves 10 or 15 minutes. Headaches and tenderness may be treated by electricity. Organic diseases also have been treated by this method. The general rule in such cases is to wait until the acute symptoms have subsided before applying the treatment. The use of massage and application of cold or other methods of treatment can only be learned by actual experience.

The drugs which are used in different diseases of the brain are morphine and other hypnotics, bromides, hyoscyamine and similar preparations, also the large group of the newer analgesics as anti-fibrine, etc. These are used to rest the brain. Exercise of the brain is produced by use of strychnine, caffeine, etc. Whether diet will influence the treatment of brain or nervous system is not known.

The effect of climate and temperature is the same upon the brain as upon the rest of the organism, mild warm climates act as sedatives, cold climates act as stimulants.

The methods of treatment which are used to influence the gen-

eral metabolism of the body may be divided into Direct and Indirect. No organ is influenced but the general metabolism as a whole. There are many diseases in which no special organ suffers, but where the body as a whole is affected. It may be that future research will show that in the diseases the real cause is the impairment of one organ, but at the present time we lack this knowledge and therefore we influence the general metabolism in hope of bringing about such changes as will ameliorate the condition so that a cure may be possible.

Diabetes Mellitis is a chronic disease in which we believe the consumption of sugar by the organism is decreased. The quantity of sugar which does not become oxidized circulates in the system and is finally excreted with the urine. The cause of diabetes is not known. We do not know whether it is due to impairment of the functions of the pancreas, liver, etc.; we only know that in diabetes mellitis the metabolism is abnormal, the consumption of sugar is decreased and the whole organism suffers. By diminishing the sugar formation in the organism the possible consumption of sugar may become proportionate to the formation and the symptoms due to the sugar in the circulation will be relieved. This method of treatment has not in view the cure of diabetes, but simply to change the altered metabolism. How is such a method consistent with the idea that we treat disease by increasing or decreasing the activity of the organism? The activity of any organ depends upon the functional action of the mass or the single cells which constitute that organ. The normal function depends upon the normal action of the cells, and if this ceases the normal activity will suffer. In diabetes we do not know which are the organs, only that certain cells are unable to perform their work of oxidizing the sugar, and a certain amount of it is not used up.

We offer less work by diminishing the sugar formation to the sugar-consuming parts and by prolonged rest the cells may recover their activity and consume more sugar. If the sugar is increased gradually, the work of the cells is increased, and if the sugar consumption is normal after a period of decreased activity the diabetes is said to be cured. The method is based upon changes in the metabolism, but the principle remains the same, that in all methods of treatment we try to cure by resting or exercising the diseased cells or organs.

The metabolism is influenced first by influencing the formation and excretion of such products as are necessary to maintain the normal processes. By increasing or decreasing the formation of

these products from the normal, we will influence the whole metabolism as the whole metabolism is dependent upon the action of the different organs. The normal functions depend upon the ingestion of different food stuffs as proteids, carbohydrates, fats, salts and water. In speaking of the different methods of treating the alimentary canal we learn that a certain amount must be taken to keep up the normal but that the proportions may be changed to a certain extent without injury to the organism. The method of influencing the metabolism by these changes will now be considered more in detail.

How can we influence proteid metabolism? It is increased by increased proteid ingestion. The consumption of proteid substances in the body will be greater the less other food stuffs are present in the food. On the other hand proteid consumption will be diminished by ingestion of less proteid substances or if the carbohydrates and fats are increased.

We know by actual experience with a pure proteid diet the consumption of proteid is increased but no retention of such material takes place, or only to a very slight extent. An emaciated patient never improves in weight and strength if only proteid material is used. The fact that proteid material is so easily destroyed led Voigt to the following hypothesis. Proteid material after absorption into the system is used in two ways. 1. A small quantity of proteid goes toward building proteid tissue, replacing the waste of these organs which becomes used up. This proteid is called Organic Proteid. 2. The larger part is not used to form new tissue but merely circulates in the system, and is burned up. It produces energy and heat and is called Circulating Proteid. This explains perfectly well the observed facts. By increase of proteid diet we increase proteid consumption without appreciable increase in tissue formation.

If we intend that proteid material be used as organic proteids, we should increase the proteid ingestion. If we intend to build up new tissue and increase proteid material, we must increase carbohydrates and fats. Such a method will be successful where large amount of tissue has been wasted, especially in the case of severe sickness, as typhoid fever, etc. If the convalescent is fed exclusively on proteid diet he will not gain in weight. If it is desired that the proteid material ingested should act as organic proteids, increase only the fats and carbohydrates and leave the quantity of proteid slightly above the normal. We use this method of treatment to prevent tissue consumption. In lung diseases,

etc., where proteid consumption is great, the carbohydrates and fats should be increased and not the proteids.

Methods of influencing fat metabolism. It is known by experiment that the accumulation of adipose tissue in the organism is mainly due to the fat contained in the food. Adipose tissue may also be formed when the food does not contain fat but only a large quantity of proteid and carbohydrates. By taking only proteid food there will be no accumulation of adipose tissue. Adipose tissue depends first on the fat contained in the food, and secondly upon the carbohydrates. If it is intended to increase the adipose tissue use the normal quantity of proteid and increased the quantity of fat and carbohydrates. Normally adipose tissue is formed from the fat in the food. in case the food contains enough fat and carbohydrate material. Proteid material alone cannot form new muscular or adipose tissue. To decrease adipose tissue the best way is starvation, but at the same time this may prove very dangerous, as the organism from hunger does not lose fat only, but also precious proteid material. The abstinence from food can be kept up for a limited time only and requires close observation of the patient. Exclusion of fats from the diet will reduce the adipose tissue.

One method to reduce adipose tissue is to give the normal quantity of food but to reduce the carbohydrates and at the same time giving a fair amount of fat. Ebstein favors the following method. In order to reduce obesity he gives.

Proteids 100 grams, Normal quantity is 100 grams.

Fat 85 grams, Normal quantity is 50 grams.

Carbohydrates 50 grams, Normal quantity 500 grams.

It is simply a decrease of the carbohydrates. The normal proportion is Proteids 2, Fats 1, Carbohydrates 10.

Banting's Cure increases the proteids and decreases mainly the fats and secondly the carbohydrates as follows. Proteids 170 grams, Fats 8 grams, Carbohydrates 80 grams.

Oertel's method for reducing adipose tissue consists of proteids 160 grams, fats 25-40 grams, carbohydrates 70-120 grams. In all of the above methods the carbohydrates are reduced. If one is reduced another must be increased. All three methods are used to reduce adipose tissue and which one is to be used will depend a good deal upon the constitution of the patient. Fat and anaemic patients will stand the Banting method best, while plethoric patients will stand the Ebstein cure best.

In the last seven or eight years a new method has come into use, that is the reduction of fatty tissue by medicine. When the thy-

roid gland is taken internally it may in suitable cases reduce body weight, due to the loss of adipose tissue. It must, however, be used very cautiously, lest dangerous symptoms arise. The subject may lose precious proteid material, and in order to control the treatment the urea must be determined in every case, as the patient should never be allowed to use up muscular tissue. The thyroid and diet treatment combined will give better results than either alone. No matter what method is used the patient must always be carefully watched.

How to Influence the Carbohydrate Metabolism. They are found in two forms in the system: I. Glycogen in the liver and other organs; II. Sugar in the blood. If the carbohydrates are excluded from the diet the reserve of glycogen in the liver will be reduced, but the quantity of sugar in the blood remains constant. The sugar must be formed from the proteid ingested or that in the system, as a strict proteid diet in patients suffering with diabetes will not stop the sugar in urine. The carbohydrates are restricted in the treatment of diabetes mellitis, and if sufficient proteid material is taken they may be excluded for weeks without any injury to the system. At first it is very hard for the patient to abstain from carbohydrates and there may be severe intestinal disturbance. Some patients stand it much better than others. This form of diet should not be kept up longer than two or three weeks and as soon as the patient loses constantly in weight it should be stopped.

Under the pure proteid diet patients cannot increase in body weight and in many cases these patients cannot retain their own weight. Begin immediately in such cases with a proteid and fat diet and by so doing the sugar may disappear from the urine in three or four days as well as the subjective symptoms. The patient should then gradually be given carbohydrates. Strict diet should be continued for two or three weeks if the patient does not lose in weight. A small quantity of carbohydrates may be allowed at the end of the second or third week but the quantity should not be large enough to allow sugar to appear in the urine. In severe cases this cannot be done because of the loss of flesh and in such cases as small a quantity of carbohydrates should be given as is consistent with the subjective symptoms of the patient.

In case the diabetic does not lose flesh such a strict diet must be continued. There is a great difference of opinion among physicians as to whether to commence this diet at once, or gradually so that the patient may become used to it. Both methods have given good results. Patients often complain bitterly on a strict diet.

As soon as all the sugar has disappeared the subjective symptoms as itching of the skin, thirst, etc., will disappear. Such a change for the better may encourage the patient to keep up his diet and so it is recommended to make the change suddenly in order to get this mental effect.

In tuberculous patients such a strict diet may prove disastrous and in thin patients it may be wiser to gradually diminish the carbohydrates. Where fat is to be reduced it seems best to reduce the diet gradually. In diabetic patients, especially where large amounts of sugar are being passed it is very often best to restrict at once. The condition of patient has to be very carefully considered. Fat patients can usually be put on a strict diet at once but it is just the opposite with thin ones very often. Patients will always lose three or four pounds the first week but it must never be let go beyond this, if they continue to lose stop the proteid diet.

Methods of treatment by changing the WATER and SALT in the food. Increase or decrease in both these constituents will cause a corresponding change in the metabolism. The influence of diminished quantity of salt has been considered in the sodium chloride group. It is practically never used in therapeutics.

To avoid the increase of mineral constituents, distilled water methods have been used, but distilled water is injurious to organic life and should not be taken for long periods. There is sufficient salt taken with ordinary food stuffs so that a surplus appears in the faeces. Drinking distilled water would only decrease the salt in the faeces and therefore would never have the desired end. The influence upon the metabolism by increased ingestion of water has been considered when speaking of water. A decrease in the quantity of water taken has been used in therapeutics. In the last 20 years Oertel has laid special stress upon this method of treatment. He decreases the quantity of water to reduce the work of the heart and other organs. A certain quantity of water is absolutely necessary not only for digestion and absorption, but also for the excretion of the waste products. A diminished quantity of water may be used in such cases where the system has too much retained fluid, as in cases in ascites and oedema. In all other conditions it may lead to serious complications, by causing the retention of waste products of health or disease.

We may influence the general metabolism by many other means. All the different methods of treatment have been spoken of, in con-

sidering the general therapeutics of the organs of the body. The methods consist in cold and warm baths, high and low altitudes, active and passive use of muscles, electricity and massage. Besides these methods medicinal treatment by drugs may be used, as fever by antipyretics, pain by analgesics, anaemia by iron and arsenic, etc.

URIC ACID. There are no general indications for the treatment of this. In general the more proteid ingested the more uric acid is formed, but whether it is reduced by the ingestion of fats and carbohydrates in sufficient quantities is not stated. In gout where there is an excess of urates in the system, some physicians reduce the carbohydrates while others reduce the proteids. In the last few years some very interesting experiments have been made and from these it seems that the amount of uric acid excreted does not depend so much upon the amount of proteid ingested as upon their kind.

Patients were given food containing much nuclein and the quantity of uric acid was increased two or three fold, which result could not be achieved by an ordinary proteid diet, thus indicating that the nucleo-proteids are more closely related to the formation of uric acid than the ordinary proteids.

The use of special drugs is determined partly by the prominent symptoms the patient complains of and by the special merits which the drugs possess. When to use drugs and the special drugs to be used must be learned in special clinics. Special therapeutics consists only of methods of treatment and their relative value when their use is indicated. General therapeutics is based on the actual amount of knowledge the physicians and scientist at large possess.

First correct diagnosis.
Then knowledge of actions of drugs & of
chemical compounds.

~~1926~~ = 1926
76

Dosis } Simple prescription.
Solvent }

Never use & avoid abbreviation.

Metric system is used now.

P R E S C R I P T I O N W R I T I N G .

A Prescription (from the Latin “prae,” for and “scribo” I write) is the term applied to the order from the physician to the pharmacist to compound certain drugs or remedies therein mentioned.

As for the convenience of all concerned drugs are given in certain usual forms so also are prescriptions written according to certain rules. A prescription is divided into four parts:

I. The ^{Supra}~~SUB~~SCRIPTION or heading indicated by the symbol R, standing for the Latin word “Recipe,” “take.”

II. The INSCRIPTION, containing the names and quantities of the ingredients.

III. SUBSCRIPTION or orders to the pharmacist.

IV. The SIGNATURE, which includes the orders to the patient, the physician's name and the date.

The above are expressed by the following Latin terms:

I. PRAEPOSITO. II. PRAESCRIPTIO. III. SUBSCRIPTIO. IV. SIGNA.

The names of the drugs and the orders to the pharmacist are always written in Latin and the remainder of the prescription always in English. Prescriptions are further divided into Simple and Compound. A simple prescription is one in which the inscription contains but one drug as for example:

R

Infusi Digitalis.

120.00

Da Signa (or Signa): Teaspoonful in water every four hours.

Sept. 7, 1896.

M. D.

A Compound Prescription is one in which there is more than one ingredient called for in the inscription. The inscription in a typical compound prescription should contain the following parts:

1. Basis or principal active agent.
2. Adjuvant or auxiliary to aid the action of the Basis.
3. ^{Corrective}~~Corrective~~ to modify or mask unpleasant tastes or smells.
4. Solvent, Constituent or Excipient. If the prescription is to be liquid, a solvent or dilutant is used, if it is to be solid, an excipient is used to dilute it or give it consistency.

℞ Chloralid 20.0
Aque ad 100.0

~~℞~~ Sig. $\frac{gt}{i}$ in glass SS milk before bed.
To sleep 3-4 nights in succession.

Active principles.

Alkaloids (Atropine, Morphine.)

Glycoside. (Digitalin)

Resinone (active)

Neutral substances.

Colloid substances & resins may hinder
action of principles.

Each of the above should be written on a separate line. The following is a good example of a compound prescription.

I.	R	
II.	Infusi Digitalis (Basis)	80.00
	Potassii Acetatis (Adjuvant)	15.00
	Spiritus Chloroformi (Corrective)	10.00
	Aquae (Solvent)	200.00
III.	Misce.	
IV.	Da Signa. One tablespoonful every four hours.	
	Date	M. D.

I. Praescriptio. II. Prescriptio. III. Inscriptio. IV. Signa.

All compound prescriptions are not of course typical. Many of them omit either the adjuvant or corrective or both and are still perfectly correct, as the basis may not and does not in many cases need either the one or the other. The BASIS is the all important feature, the others are only secondary and to it must be given the most careful consideration as it is what you are depending upon to produce the desired effect.

The first and fundamental fact in writing a prescription is the choice of a remedy. In order to do this a knowledge of the different drugs and their preparations is necessary. The local and general actions of the different groups should be known, and also if one member of a group is preferable to another, also the peculiar effects of certain drugs on certain persons known as Idiosyncrasy should be taken into consideration. In almost every case this means increased susceptibility to the drug.

After the choice of a remedy the next consideration will be as to what preparation of the drug to use. To a certain extent this will depend upon the method of application, the use whether internal or external, and as to whether a general or a local effect is desired. If it is to be used in powder or pill form probably a dry extract, stable salt or the crude powdered drug will be best, while if in liquid form a tincture or fluid extract may be the more convenient. The method of giving a drug depends in quite a measure upon the taste of the physician, although in some cases he is more or less limited, as where insoluble or incompatible drugs are prescribed. After the choice of a remedy the amount to be called for is next thought. This may depend somewhat upon the form of the prescription, whether liquid or solid. In liquid forms the TOTAL amount of the drug necessary for the whole prescription is always given, never the amount of a single dose. It is therefore neces-

sary in these prescriptions to decide upon the amount to be given as a single dose and also the number of doses to be given. If an adjuvant, corrective or solvent is to be given with the basis the entire quantity of these has also to be called for.

It is customary in prescribing liquid medicines to have the amount of the mixture that the patient is to take of convenient size so that it can easily be measured out. If the quantity of the basis is such that the dose of it would be small or inconvenient to handle sufficient of a solvent or dilutant is added to it so that each dose can easily be measured out and handled. For example, the dose of the fluid extract of nux vomica is from 0.030-0.600. This is a very small quantity and would be impossible to handle or take with any degree of safety by the ordinary person; therefore it is usually given in combination with some dilutant of an inert substance, or with some other drug having a mild action and whose dose is of a convenient size, as for example:

R

Extracti Nucis Vomicae Fluidi	3.00
Aquae	ad 150.00

or

R

Extracti Nucis Vomicae Fluidi	3.00
Tincturae Gentianae	ad 150.00

These two prescriptions are written so that each 5 c.c. or a teaspoonful of the mixture contains 0.100 c.c of nux vomica. This makes a convenient sized dose and also gives a mixture of a fair quantity, that is enough to last for ten days, three doses per day of 5 c.c. each.

The best way of course would be to have the patient get a small glass graduate and use that for measuring the doses, but this cannot be done in very many cases so that the ordinary measures of quantity have to be resorted to.

Drugs should never be ordered to be taken in doses of so many drops. This is a dangerous practice as it is powerful drugs which are usually ordered to be taken this way and a drop or two more than the order may prove altogether too large. Drugs of this kind should always be mixed with a sufficient quantity of a dilutant so that the dose shall be a fair amount such as a teaspoonful. Drops of various substances as will be seen in a table given later also vary very much in size and therefore in the amount of active principle they contain.

The rule for finding the amounts needed of the drugs called for in the prescription may be briefly put as follows:

Multiply the number of doses per day by the number of days for which it is intended to give the medicine. Then multiply this product by the amount of each drug desired to be given as a single dose. For example, 0.500 of Potassium Iodide is to be given three times per day for ten days. The amount needed is calculated as follows: $3 \times 10 = 30 \times 0.500 = 15.000$.

In prescriptions for Pills and Powders the entire amount needed may be given, as in fluid prescriptions, or only the amount needed for a single pill or powder. Where the entire amount needed is given the pharmacist is ordered to divide it up into the required number of pills or powders of that size. For example:

R	Salol		
	Phenacetini	aa	1.500
	Misce.	Divide in partes equales No. X.	
	or		

R Salol
 Phenacetini aa 0.150
Misce. Fiat pulvis. Detur doses tales No. X.

In both of the above prescriptions the same number of powders with the same amount in each are called for, the difference being that in the first the entire amount of the drugs needed for the ten powders are given and the pharmacist ordered to mix them and then divide the mixture into ten equal parts; while in the second the amount needed for one powder is given and he is ordered to make ten such powders. Pills are written for in exactly the same way.

R	Extracti Belladonnae Radicis Fluidi	1.800
	Pulveris Glycyrrhizae	3.00
	Misce et fiat massa e qua formentur pilulas No. XXX.	
	Fiat pilulae No. XXX.	

R	Extracti Belladonna Radicis Fluidi	0.060
	Pulveris Glycyrrhizae	0.120
	Misce et fiat pilula. Detur doses tales XXX.	

Either way is perfectly correct. It is much better and safer however to adopt exclusively either one method or the other and not a mixture of both as in the latter case mistakes are much more liable to occur.

In the ordering of Cerates, Ointments, Liniments, etc., the same rule as with fluid preparations is followed, that is the total amount required is always written for.

The names of the drugs and the orders to the pharmacist are always written in Latin and of course in order to do this properly a certain knowledge of Latin is necessary. The writing should be easily read and preferably in ink. Every drug should have a separate line and the quantities following it should be clear and plain. Likewise the orders to the druggist and the patient should be written so that there may be no mistaking them.

Abbreviations should not be used except where there is no possibility of misunderstanding them. In using powerful drugs the rule should be made to write them out in full. The principle to guide in all abbreviations is that of clearness, so that if there is any chance for a question it is your duty to the pharmacist and patient as well as to yourself to guard against it as far as possible. By non-observance of this many serious mistakes have occurred. This of course applies more particularly to the body of the prescription as the sign R is almost invariably used and is just as clearly understood as would the word Recipe. The subscription may often be shortened to advantage as in the substitution of M. for Misce, Sig. or Signa for Da Signa, etc.

In writing the prescription the first thing will be the *prae-posito* or heading. For this the sign R is sufficient.

Immediately after this will come the main body of the prescription containing the names of the drugs and their quantities. The Latin names of all the drugs are used and always in the genitive case, except where the preparation is already compounded according to a given formula of the Pharmacopeia. In the latter case they are put in the accusative case. This latter condition is found practically only in the standard pills as for instance *Pilulae Ferri Carbonatis* or *Pilulae Aloes et Myrrhae*. If the pills are ordered to be prepared and not the official ones of the U. S. P. the names of the ingredients are then put in the Genitive case the same as in any other prescription.

Under another heading will be found the nominative termination in which the drugs are used in the *Materia Medica*, with the endings of the corresponding declension. The Latin names of the drugs and their genitive and the accusative endings in those cases where the accusative is used to any extent, should be committed to memory. This will facilitate greatly the writing of a good prescription. In many cases in learning the Pharmaceutical name the genitive is learned with it as for instance *Morphinae Sulphas*, or Sulphate of Morphine. When this is put into a prescription it will read *Morphinae Sulphatis*, as the nominative *Sulphas* would have to be

changed into the Genitive according to the rule that the names of drugs are always put in the genitive, while *Morphinae* would remain as it is because it is already in the Genitive. The same is seen in *Tinctura Opii*, this becoming when in a prescription *Tincturae Opii*.

The Genitive case in Latin is used to denote the idea of possession which in English is represented by the noun preceded by the preposition "of" therefore where ever we find these in English they will be represented in Latin by the Genitive, for example "of Morphine," becomes when put into Latin, "*morphinae*."

In pharmaceutical compound names where there is already a Genitive as in *Tinctura Opii*, it is only the nominative that is changed into the Genitive. *Tinctura* becomes *Tincturae* while the *OPII* remains at it is because it is already in the Genitive case.

The quantities of the drugs are the direct object of the verb *Recipe*. If they were written out in words they would be put in the accusative case which is the equivalent of the objective in English but as figures are used entirely in the Metric system and symbols in the old system of Apothecaries' weights this needs no farther consideration. When the name of a drug is modified by an adjective the adjective agrees with the noun it modifies in case, number and gender. This is according to the Latin rule that an adjective must agree with its noun in these three particulars. Thus the adjective modifying the name of a drug as it stands in the *Materia Medica* will be in the nominative case but when it is put into a prescription it will be in the genitive case agreeing with its noun as according to a formed rule; drugs are put in the genitive case when calling for them in a prescription. For example:

Tinctura Cardamoni Composita (nominative) becomes when in a prescription.

Tincturae Cardamoni Compositae, the adjective *compositae* agreeing with its noun according to rule.

Cardamoni of course is a noun and not an adjective so it does not have to follow this rule but is in the genitive case in the name as well as when written in the prescription, the name of the preparation is Compound *Tinctura* of Cardamon and as before stated where the preposition "of" is used in English its place is taken in Latin by the Genitive.

This same rule also explains why *Pilulae Catharticae Compositae* becomes when written in a prescription.

Pilulas Cartharticas Compositas instead of Pilulas Cartharticae Compositae.

Catharticas and Compositas are adjectives modifying Pilulas and therefore wherever found must be in the same case. If pilulas is in the nominative case they must be in that case, or if in the accusative they must be in that.

It may not be understood why Pilula is put in the accusative case instead of the genitive in this prescription, but this is according to the exception before noted at the beginning of this section, that preparations which are already compounded according to the pharmacopeial formula and which are supposed to be kept in stock by the druggist, are put in the Accusative case and not in the Genitive. As before stated almost the only preparations which belong to this class are the standard Pills, such as Blauds, Compound Cathartic, etc.

If the name of a pill contains a genitive it retains that genitive in the prescription, for the reason previously given that the genitive is a noun and does not follow the rule of adjectives. The genitive is necessary to make the complete name and therefore could not be put in the accusative case as that would give the name another sense, This is illustrated by the following:

Pilulas (acc.) Aloes et Ferri.

Here Aloes et Ferri are in the genitive case as the name is Pill OF Aloes and Iron. Pilulas is in the accusative according to rule.

The preparation may be made according to the standard formula and yet when called for in the prescription it will have to be put in the GENITIVE case. This is true only of those preparations which are made up in bulk according to the formula but which have to be weighed out by the pharmacist.

They are not already made into quantities containing a certain dose but are made in bulk, their proportions corresponding to the formula. This is well shown by the preparation which is commonly known as Dover's powders. The formula calls for a powder containing one part of Ipecac, one part of powdered Opium, and eight parts of Sugar of milk. It does not say that it shall be a powder which shall contain .05 grams of Ipecac, .05 grams of Opium and .40 grams of Sugar of milk, but simply says that it shall be a powder containing those ingredients in that proportion. It does not stipulate whether one gram or 100 grams are to be made, all that is necessary is to have the proportion correct.

If the physician wishes to use Dover's Powder he has to write a

prescription telling how much is to be used for each powder and how many powders are desired. He cannot order ten Dover's Powders as this would be meaningless to the druggist, but he has to specify say ten powders each containing .25 grams or .50 grams or whatever amount he chooses. The druggist can now weigh out from the powder which is already prepared in bulk the amounts called for in the prescription. The physician knowing the composition of the preparation knows just how much of the active agent is in each part of the powder and can order accordingly, so that if he orders powders containing 0.50 grams each he knows that in each one the patient is getting .05 grams each of ipecac and opium.

Preparations which are put up in this form are those which are used to quite a large extent, such as Dover's Powder, and are prepared beforehand in quantities as a matter of convenience to the physician and pharmacist.

Preparations which are made according to a formula and in bulk and of which certain definite amounts have to be called for by the physician must always have their names put in the Genitive case in the prescription, for example:

R	Pulveris Ipecacuanhae et Opii	5.00
	Fiat in Chartulas No. X.	
	Signa One before going to bed.	
	Sept. 7, 1896	M. D.

or

R	Massae Hydragyri	3.00
	Fiant Pululae No. X.	

Standard preparations should be always called for under their Pharmaceutical names and should never be written out for in full.

Dover's powders will again serve as a good example. This should be written for as

R	Pulveris Ipecacuanhae et Opii	0.500
	and not	
R	Pulveris Opii	0.050
	Pulveris Ipecacuanbae	0.050
	Sacchari g acti	0.400
	Misce Fiat Pulvis	

The latter form is wrong and should not be used, the first is the proper one.

These exceptions always seemed to be the hardest part of prescription writing to understand, and so they have been dealt with at considerable length, perhaps more so than was necessary, but it

seemed best to err on the side of clearness, rather than brevity.

THE SUBSCRIPTION consists of necessary directions to the pharmacist for the preparing and compounding of the remedies in the desired form, as for example.

Misce et divide in partes equal~~u~~X. (mix and divide into ten equal parts). It should always be written in Latin.

THE SIGNATURE concludes the prescription and consists of the directions to the patient, followed by the date and physicians name.

This portion is always in English and should be written out in full. All that is necessary for the patient to know in regard to the taking of the medicine, as dose, time of taking, number of doses per day, etc., should be included in this. It is best never to leave it to memory as the patient is quite liable to forget some of the directions more especially if there is more than one medicine given. For this reason if for no other the use of the phrase "as directed" which is so commonly used should be avoided entirely.

This portion of the prescription is copied on the label verbatim, therefore it should be written very clearly, so that there may be no chance for a mistake in the transcribing of it. This when properly done often saves the patient or attendants much trouble as it obviates the possibility of any confusion as to the intentions of the physician.

THE DATE is generally put in the lower left-hand corner and the physician's name in the lower right. As the title Dr. is given to so many questionable professions it is generally preferable to use the letters of your degree, as James King, M. D.

After a prescription is written every item should be carefully examined to see that no mistake has been made. Many physicians before going over their prescriptions lay them to one side for a minute or two so that they may "get cold" as they term it. When they pick them up to examine them the composition is not so fresh in their minds as if examined as soon as written, and if there is a mistake it is not so liable to be overlooked. This is a very good practice.

Prescriptions should be written on paper of a convenient size. Most physicians have their own blanks with their names, office, telephone number, etc., printed on them. These are very convenient and at the same time aids the pharmacist in finding him in case a

question arises in regard to anything in the prescription.

DRUGS which are not soluble but are only in suspension should always bear a "shake" label. Poisons also should always have the word "Poison" in large letters on the bottle, unless for certain reasons it is not desirable for the patient to know what he is taking.

Powerful drugs should NEVER be given in SUSPENSION for if the bottle is not thoroughly shaken the supernatant layers will contain less of the active principle than the lower ones, so that an equal amount of the upper layer will not be so powerful as one of the lower, and as the amount in the bottle becomes less and less with each dose, unless great care is taken to shake thoroughly each time the latter end of it will contain a great deal more of the drug per dose than was intended. This is a rule which should be ironclad.

The name of the patient is often put upon the prescription and is a practice to be recommended especially if there is more than one patient in the family. This is done principally for convenience, but in case of a mistake may be valuable as a reference.

When a very large or unusual dose of a powerful drug is ordered it is best to indicate it by some mark or reference to that effect as "Large dose intended", "This amount is correct", etc. If this is not done a careful druggist may refuse to put up the prescription until he has consulted the physician. By doing this trouble may be avoided and perhaps valuable time saved.

If it is desired that the prescription should not be refilled unless especially reordered the term "Ne Repetatur" (do not repeat) is used. Such an order will generally be followed by the pharmacist.

INCOMPATIBILITY. Certain drugs cannot be prescribed together because of their chemical affinity for each other, that is, they would act upon each other and a new compound would be formed, entirely different from the original substances. This is termed INCOMPATIBILITY. This may be illustrated by Ammonium Chloride and Nitrate of Silver. If these are mixed together a new compound, Chloride of Silver, is formed.

If the new compound formed is intended the drugs cannot be said to be incompatible, the preparation known as "Black Wash" illustrates this. Here calomel and lime water are mixed together and a chemical reaction takes place but as this is intended they cannot in this case be said to be incompatible as under ordinary circumstances they would be.

No definite rule can be given in regard to incompatibility. The incompatibles of several of the more important drugs will need to be committed to memory, but a general statement which will help is here given.

Closely applied to Chemical Incompatibility is the change that some drugs undergo upon exposure to light or air, as for instance Solution of Silver Nitrate becoming dark or powders of Potassium Acetate becoming deliquescent. This may be avoided by the use of dark colored bottles in the first case, by air tight stoppers if in bulk, or by use of wax paper if in separate powders in the second. It is better however if the drugs deliquesce easily, to order them to be put in solution.

There is also what is known as THERAPEUTICAL INCOMPATIBILITY but this is not a strictly true term. By this is meant the compounding together of drugs that are naturally antagonistic, such as Morphine and Caffeine, or Digitalis and Atropine. There is in reality no such thing as Therapeutical Incompatibility, for although the actions of two drugs are the opposite of one another yet it is often desirable to combine them together in order that the action of one may counteract some of the effects of the other that are not desired.

This term may be also applied to the combination of drugs that cause a more insoluble or inelegant mixture, as the combining of solutions of iron with tannic acid or drugs which contain it as Tincture of Ferric Chloride with Tincture of Cinchona, or tinctures of resinous drugs with water solutions.

An example of Therapeutical incompatibility is seen in the use of Phenacetine and Caffeine. Phenacetine is a depressant and analgesic, while Caffeine is a stimulant. It is often desirable to use the analgesic properties of Phenacetine as in neuralgia or Migraine, yet we do not care to depress the system too strongly so Caffeine is generally used in combination with it to overcome this action, thus we have the one action of the drug this is desired without the other or with it modified to quite an extent. The following prescription is one that is very commonly used and illustrates this exceptionally well.

R	Phenacetini	1.500
	Camphorae Monobromatae	0.300
	Caffeinae Citratis	0.300

Misce. Divide in partes equales No. X.

Signa. One every three hours until pain is relieved.

No definite set of rules can be laid down as regards incompatibility, as the special incompatibilities of a large number of drugs will have to be learned for each separately, but the following list covers it almost as fully as practicable by general rules.

GENERAL RULES. *Only*

Acids are incompatible with bases, basic salts, neutral tartrates, soaps and sulphides.

Bases are not to be prescribed with acids, iodine, chlorine, bromine, fats or balsams, *chlnal, alkaloidal salts*

Salts are not to be prescribed with acids, bases, soaps or other salts with which they may become decomposed.

Salts of the heavy metals not with ~~alkalies~~, bases, sulphur compounds, tannates, ~~coloring matters~~, soaps, alkaloids and ~~many~~ ^{other} organic substances.

Tannates and coloring matters not with alkaloids or compounds of the heavy metals. *(only) (only)*

Silver, lead and mercurous salts are not to be prescribed with chlorine, bromine or iodine compounds. Lead salts not with sulphuric acid or soluble sulphates. Silver salts not with any reducing organic substance,

Gums and mucilages are not be prescribed with lead acetate, silver nitrate, borax or alcohol.

Alcoholic solutions of camphor and ~~ether~~ ^{similar} resinous matters, *and camphor* are not be prescribed with water as they are thereby precipitated. Many fluid extracts act likewise. Cocaine and borax cannot be given together as they form an insoluble compound, but cocaine and boric acid may be mixed together. *Fluid extract should not be mixed with water.*

Dosage. The term DOSE is used in prescription writing to indicate the amount to be taken at one time. With each drug in the Materia Medica is given a maximum and minimum dose with quite a variation between them; but although a knowledge of these doses is essential, yet the cannot be considered absolute as the dose prescribed must vary more or less depending upon many conditions. One of the most important considerations in determining the size of the dose is

AGE. The doses which are given in the Materia Medica are those for adults. None are given for children or young people, although it is perfectly apparent that they must be smaller than the adult dose. Many rules have been tried to simplify this matter. The following seems to be the simplest and best and is the one most generally in use:

Young's method.

Doses herein given are maximal for adults 25-60 yrs.
Women & old men less.

Always ask patient if he has ever before had drug
you intend to prescribe.

Children are very susceptible to morphine, but can
take large doses of calomel.

Women in time of menstruation avoid medicine.
Don't salicylate ect. increase menstruation, which
you don't want. In pregnancy you avoid those drugs,
which increase flow of blood to abdominal organs
e.g. quinine, all resins, gum resins.

Look out for accumulative property of some drugs

Add to the age of the child 12. This will give you the denominator of a fraction whose numerator is to be the child's age. Multiply the adult dose by this fraction and the result will be the proper dose for the age.

Example. Age 4 years.

$4+12=16$ =denominator. Age=numerator $\frac{4}{16} = \frac{1}{4}$ therefore fraction will be four-sixteenths, equals one-fourth. The dose then for this age will be the adult dose times one-fourth or one-fourth of the adult dose.

Let us say for instance that the adult dose of a drug is two grams, then for a child 6 years old it will be .66 grams.

Age $6+12=18$. Six-eighteenths equal one-third.

Adult Dose equals (two grams) times one-third equals two-thirds grams, equal .66.

In prescribing for children the fact that they bear some drugs very well and others very poorly must also be remembered. For example children stand opium very poorly being especially susceptible to it while they bear Belladonna very well usually.

SEX also has a bearing upon the dose, women as a rule requiring a somewhat smaller dose than men.

CONDITION OF HEALTH. An enfeebled patient required a smaller dose than ordinary. If there is much pain larger quantities of the hypnotics will be needed than usual. This is illustrated by morphine. Eight milligrams is usually sufficient to produce sleep, yet if there is severe pain two or three times the amount may be necessary.

MEDICINES when used for some time lose their effect and in order to produce the desired result the dose must be increased from time to time. This may often be avoided by changing every few days from one member of a group to another and then back again, as from urethan to sulphonal and then back to urethan again, if it is desired to continue their use longer.

IDIOSYNCRASY. Some people are peculiarly influenced by certain drugs, such as morphine. Idiosyncrasy almost invariably means increased susceptibility. It is often well to inquire before giving the drugs which belong to this category as to whether the patient has ever taken them before.

METHOD of ADMINISTRATION. The dose will also vary according to this. The amount of a drug administered hypodermically will be much less than if given by the mouth.

THE DIFFERENCE in Action of large and small doses of some drugs. Ipecac in small doses is an expectorant yet in large doses it is a powerful emetic.

MEDICINES should not be prescribed during menstruation or lactation or to pregnant women except when unavoidable.

The prescribed dose should always be of convenient size, for instance a pill should not be so large as not to be readily swallowed nor a powder so small as to be inconvenient. If the active principle is too large to be taken easily at one time it should be divided and if too small enough of an inert substance should be added to make it of proper size. This is especially true of pills and powders.

WEIGHTS and MEASURES. Two systems of weights and measures are in use at the present time, the Apothecaries or Troy and the Metric systems. The former are more in use by the older practitioners, but the latter is coming more and more into vogue on account of its simplicity and ease of application. It undoubtedly has many advantages over the Troy system, especially in the use of but one unit of measure, with its division into tenths, hundredths and thousandths and the resultant ease with which the amounts in a prescription are estimated.

The doses of the drugs are generally found in all of the late *Materia Medicae* in both systems. A thorough knowledge of either one or the other should be had so that it is as the saying is "at the finger tips," and a sufficient knowledge of the other so that the Metric can be easily transposed into the Troy or vice versa.

It is best not to use a mixture of both systems, that is, use the Metric in some prescriptions and the Troy in others, but to use either one or the other altogether; this saves confusion and the added possibility of mistakes arising from it.

The doses of the drugs should be learned in whichever system you decide to use and not part in one and part in another. A knowledge of the rules for transposing from one to the other will enable you to change from one to the other easily and yet save the necessity of learning the dose of each drug in both systems. The danger of learning the doses partly in one and partly in the other is that sometimes you may forget whether it was grains or grams and use the wrong one in making out your prescription.

In the APOTHECARIES' or Troy System symbols are used to express weights and measures.

In the METRIC System symbols are not used. The unit of weight

is the gram, and of measure its equivalent the cubic centimeter, These are represented by the abbreviations G., gm., grm., and c.c. This is the system of decimals with which we are all familiar. Script figures are here used and as we have the decimal fractions are not needed as they can be expressed by the use of the point.

In speaking of the weight or measure of anything the terms gram, decigram, centigram, milligram, cubic centimeter (c.c.), tenths or hundredths of a cubic centimeter are used.

A gram and a centimeter are equal, the gram having the weight of a cubic centimeter of water at a given temperature. The table of relative values are as follows:

1 milligram	equals	0.001 gram	
1 centigram	equals	0.010 gram	
1 decigram	equals	0.100 gram	
1 gram	equals	1.000 gram	
One one-hundredth	of a cubic centimeter	equal	0.010 c.c.
One-tenth	"	"	0.100 c.c.
One	"	"	1.000 c.c.
One thousand	"	"	1 litre.

In speaking of or writing for cubic centimeters the letters c.c. are commonly used. This is one of the abbreviations that are valuable and can be used with safety.

In prescription writing instead of a series of decimal points running down through the amounts of each item a line is used.

The abbreviations grm. and c.c. are usually omitted. The unit of weight used being the same, the pharmacist knows that either the given number of grams or cubic centimeters are intended according as to whether the preparation is a solid or a liquid.

The use of the line instead of a series of decimal points is here shown.

R	Morphinae Sulphatis	060	(0.060)
	Creosoti	360	(0.360)
	Bismuthi Subnitrat	45 000	(45.000)

Misce. Divide in partes equales No. XII.

The amount of the drug is always written in the ordinary script figures as in above prescription.

The Weights and Measures used in the Apothecaries' system are as follows:

Solid.			Liquid.		
Grains (symbol)		gr.	Minim (Symbol)		M
Drachm	“	3	Drachm	“	f.3
Ounce	“	3	Ounce	“	f.3
Pound	“	lb.	Pint	“	O.
			Gallon	“	C.

Relative Values.

Pound.	Ounce.	Drachm.	Grain.	Gal.	Pt.	Fl.3	Fl.3	Minim.
1	12	96	5760	1	8	120	1024	61440
	13	8	480		1 O.	16	128	7680
		13	60			1 f.3	8	480
							1 f.3	60

The relative values of the Metric and Apothecaries' Systems are:

1 grain equals	0.065 grams	1 minim equals	0.059 c.c.
1 drachm equals	3.89 grams	1 fl. drachm equals	3.70 c.c.
1 ounce equals	31.10 grams	1 fl. ounce equals	29.57 c.c.
		1 pint equals	473.00 c.c.

The following APPROXIMATE table of values are the ones generally used in transposing from one system to the other and are sufficiently accurate for all practical purposes:

1 grain equals	0.060 grams	1 minim equals	0.060 c.c.
1 drachm equals	4.000 grams	1 drachm equals	4.000 c.c.
1 ounce equals	30.000 grams	1 ounce equals	30.000 c.c.
		1 pint equals	480.000 c.c.
1 gram equals	15 grains	1 c.c. equals	15 minims
4 grams equals	1 drachm	4 c.c. equals	1 fl. drachm
30 grams equals	1 ounce	30 c.c. equals	1 fl. ounce
		480 c.c. equals	1 pint

Pounds or its equivalent in grams are very rarely used in prescription writing.

The following rules will be found very convenient in transposing from one system to the other:

To change from grams to grains. Multiply by 6 and divide by 100. (6 grains equals 0.360 grams. 6 times 6 equals 36, divided by 100 equals 0.360.)

From grams to grains. Multiply by 15.

From grams or c.c. to drachms. Divide by 4. (4 grams equals one drachm.)

From drachms to c.c. or grams. Multiply by 4.

From grams or c.c. to ounces, divide by 30. (30 grams equal one ounce.)

1 grain (approximately) 0.060. *grm*
 15 ⁱⁿgrams " 1.000.

In the system of Apothecaries' Weights the amount of the drug always follows the symbol and is written in roman numerals. The exception to this is where fractions are used. Fractions are put in ordinary script with the exception of one-half, for which the letters s.s. (representing semissis, one-half) are substituted. For example:

R		R	
Pulveris Opii	gr. ss	Strychinae Sulphatis	gr. 1/60
Bismuthi Subnitrat	gr. X.	Acidi Arsenosi	gr. 1/50
Misce. Fiat pulvis.		Ferri Reducti	gr. l
		Misce. Fiat pilula	

Sometimes a drop is used as a measure of liquids. This of course varies in size according from what it is dropped, as well as the specific gravity and viscosity of the liquid.

A drop of water at ordinary temperature dropped from a dropper is practically equivalent to a minim, but it must be remembered that this is not true of all liquids, as the higher the specific gravity the less number of drops will then be in a given quantity and vice versa. This is well shown by the following example.

Number of drops in a fluid drachm of

Chloroformum Purificatum	250
Acidum Carbolicum	111
Liquor Potassii Arsenitis	57
Tinctura Opii	130
Tinctura Aconiti	146

On account of this variation in the size of drops it is best to order powerful drugs in minims and not in drops.

When a patient is ordered to take a certain number of drops of a medicine, he should always be instructed to use a dropper to measure from and not the bottle on this account. It is usually better to order powerful drugs such as are generally given in drop doses with a sufficient amount of a vehicle so that they can be taken in teaspoonful doses or thereabouts, then if the patient happens to overrun his dose a little there is no harm done while with drop doses there might be.

DOMESTIC MEASURES. Because of the absence of suitable measures in the house of the patient as well as the general ignorance of the laity of the Troy and Metric systems we are accustomed to prescribe medicines to be taken in doses corresponding to the ordinary measures in use among the people.

These are teaspoonful, dessertspoonful and tablespoonful, wine glassful and tumblerful.

The ordinary teaspoonful is equivalent to about five c.c.

The dessertspoonful to ten c.c.

The tablespoonful to fifteen c.c.

Wine glassful 45-60 c.c., and tumblerful 300 c.c.

These are only approximate, and in many cases vary greatly in size, the teaspoonful varying from 2.-8. c.c. (1/2-2 drachms). Fatal results have occurred due to the extra size of some of these.

While physicians are very particular about the amount of a drug they order and also about its preparation, yet in this particular they are very lax. Medicines should be measured accurately just as much in the giving as in their preparation, yet we rarely pay much heed to this fact. This could be readily accomplished by ordering the patient to get a measuring glass graduated to whatever scale we are using, as teaspoonful, tablespoonful, etc., or to cubic centimeters. Those graduated according to Troy system have the teaspoonful equal to 60 minims, what it is supposed in all cases to be. This at least has the merit of consistency if no other. It is better not to prescribe medicine in DROP DOSES for the reasons previously stated.

A teaspoonful is the dose ordinarily prescribed unless the mixture is intended for a stomachic, aperient, etc., when a larger amount is generally used. This is not only because they are so convenient, but also because we estimated that they hold 60 minims or one-eighth ounce and in the Troy system we are accustomed to order the prescription to be put up in bottles containing 1, 2, 4, 6 or 8 ounces, unless the dose to be taken is very small, such as 5 or 10 drops. In this latter case we of course would order only drachms or their equivalent in c.c. as we do not desire to have the patient pay for more than is required.

If we prescribe in the Troy system, the relation of the quantity that the teaspoon holds to an ounce is of material help in the estimation of the amount in a prescription, for there being eight drachms to each ounce, if the drugs we desire to give have an ordinary dosage of grains or minims we have only to multiply the num-

ber of grains or minims we desire to give by eight and it will give us the amount needed in a prescription of this quantity. For instance, let us give a mixture of one ounce of Tinct. Nucis Vomicae (dose about five minims) and Tinct. Cinchonae (dose 60 minims). We do not care if the Cinchona is a little more or less than 60 minims as it is used as an adjuvant here, so our prescription will be

R	Tincturae Nucis Vomicae (5×8)	M. xl
	Tincturae Cinchonae	ad f. 3i

In prescribing for eight, four or two-ounce mixtures instead of multiplying the number of ounces desired by eight and then that product by the number of grains the following system is used as it simplifies it a good deal.

One drachm of active drug to each eight ounces of mixture equals (about) one grain to each teaspoonful, therefore in eight-ounce mixtures we have only to use the same number of drachms as what the grain dosage is and we have just the same result as though we multiplied it by the number of doses. The previous prescription made up to eight ounces will illustrate this.

R	Tincturae Nucis Vomicae (dose M. 5)	f. 3 v
	Tinctura Cinchonae	ad f. 3 viii

60 the number of doses in this mixture times 5 minims the single dose equals 300 minims, equals 5 3.

In four-ounce mixtures of course one-half the number of drachms are used and in two ounce-ones one-fourth.

Four-ounce mixtures are the ones generally prescribed as the size and number of doses is a convenient one, as they hold a sufficient quantity to last about ten days at a teaspoonful to a dose. On this account the following rule is an excellent one to remember. One drachm to each four ounces is equivalent to two grams in each teaspoonful.

The use of the Metric system makes the quantitative estimation of the amounts in a prescription much easier, oftentimes the moving of a decimal point one place to the right will be all that is needed, such as when ten powders are wanted as for example:

R	Morphinae Sulphatis (Dose 0.015)	0.150
	Sacchari Lacti	q. s.

Misce. Divide in partes equales No. X.

The following however will apply to both and is very useful in making up solutions of a certain strength such as injections, etc.

Teaspoonful to a pint equals (approximately) a 1% sol.

“ “ quart “ “ a 1/2% “ “

This is not absolutely true but is sufficiently accurate for practical purposes.

THE AMOUNT of a PRESCRIPTION should not be more than the prognosis seems to call for. If five days taking it will suffice that amount should be written for and not enough for ten days or two weeks. The extra amount is of no use to the patient and only an added expense.

Unless you know and can trust your patient throughly you should never order at any one time more than the maximum dose of powerful drugs so that if your patient by design or accident should take it all it would not prove fatal to him.

This is especially true of Opium, Cocaine, etc., when not more than is absolutely needed should be prescribed as the danger of forming the habit is very great.

IN PRESCRIBING LIQUID MEDICINES notice should be taken of the several sizes of vials and their capacities generally carried in stock by the druggist, being usually 1, 2, and four fluid drachms and 1, 2, 4, 6, 8, 12 and 16 fl. ounces. In the larger cities owing to growing use of the metric system vials may also be had 30, 60, 90, 120, 250 and 500 c.c.

While it is not essential it is much better taste to have prescription aggregate by a bottleful of one of the given sizes.

Bottles of dark colored glass are also kept in stock and should be ordered for those prescriptions which are better kept from the light, like nitrate of silver.

WORDS and PHRASES USED IN PRESCRIPTIONS WRITING.

The whole of a prescription with the exception of the orders to the patient is written in Latin. The knowledge of Latin needed to write a good prescription is however very small. Most of the words or phrases used are what might be called stock terms and can be learned verbatim very easily. The formation of the genitive and accusative cases into which the names of the drugs are put is somewhat harder to understand.

Nouns and adjectives are divided into five declensions in Latin according to their endings, but as there are no pharmacopeial nouns of the fifth declension we need to consider but four.

Each declension has six cases but it is very rarely that more than three of these are used in prescription writing and so we will

consider only those most used. The exceptions are much easier committed to memory than the rules for their formation,

A list comprising the most important is found at the end of this section.

The three cases mostly used are the Nominative, which corresponds exactly to the English nominative; the Genitive corresponding to the English Possessive usually expressed by the preposition *of* in English, and the Accusative which corresponds very closely to the English objective, and is used after transitive verbs and certain prepositions. These cases are formed by adding certain endings to the root or stem of the word. The proper ending to be added depends upon the declension to which the word belongs, which is determined by its genitive ending. The root of a given noun then is found by cutting off its genitive ending and to this root is added the proper ending for any given case.

In the majority of cases the root of a noun may also be found by cutting off the NOMINATIVE ending. This is especially true in Pharmacopeial nouns and as it saves learning the Genitive of each of them we will use it in determining the root and give the genitive form of the principal exceptions in the list at the end. It is much easier to learn this list than the Genitive ending of each word.

Nouns in Latin may be either singular or plural. This is also indicated by their endings. The plural number is not used in writing prescriptions nearly as much as the singular, yet it is well to understand its formation.

All Latin nouns have GENDER, either masculine, feminine or neuter. This is important in theoretical Latin on account of the agreement of adjectives, but concerns us very little in prescription writing as here but few adjectives are used.

The following rules are quite simple and may be worth remembering:

Nouns of the First Declension ending in "a" are of feminine gender.

Those of the Second ending in "us" are mostly masculine, and those ending in "um" are neuter.

The endings of the Third Declension are so numerous that no definite general rule can be given.

Only three nouns of the Fourth declension are used in pharmacopeial names. Of these two are masculine, "Fructus" and "Spiritus"; and the other, "Quercus" is feminine.

The names of all the drugs in the *Materia Medica* are in the nominative case; sherefore in order to find the root it is only necessary to cut off the aproprate ending, as indicated in the following scheme:

FIRST DECLENSION. All pharmacopeial nouns ending in A, excepting *Aspidosperma*, *Physostigma* and *Theobroma* are of the First Declension. of feminine gender, and are declined like *Tinctura*.

Singular Number.

	Root	Ending	
Nominative	Tinctur	a	Tinctura, a tincture
Genitive	Tinctur	ae	Tincturae, of a tincture
Accusative	Tinctur	am	Tincturam, tincture(direct object)

Plural.

Nominative	Tinctur	ae	Tincturae, tinctures
Genitive	Tinctur	arum	Tincturarum, of tinctures
Accusative	Tinctur	as	Tincturas, tinctures

It will be readily seen that the root *Tinctur*, found by taking away the ending "a" from the nominative singular remains the same throughout, and forms any given case simply by the addition of the proper case ending. Particular pains should be taken to learn the case endings of all the declensions throughly so that they are perfectly familar and can be applied without hesitation. If this is done one of the hardest points in successful prescription writing is mastered.

SECOND DECLENSION. All pharmacopeial nouns ending in us (excepting *Rhus* of the third and *Quercus*, *Fructus* and *Spiritus* of the fourth) are of the second declension, mostly masculine gender, and are declined like *RUBUS*.

Singular Number.

	Root	Ending	
Nominative	Rub	us	Rubus, a blackberry
Genitive	Rub	i	Rubi, of a blackberry
Accusative	Rub	um	Rubum, a blackberry

Plural.

Nominative	Rub	i	Rubi, blackberries
Genitive	Rub	orum	Ruborum, of blackberries
Accusative	Rub	os	Rubos, blackberries

All pharmacopeial nouns ending in "um" are of the Second Declension, neuter gender and are declined like *Acidum*:

Singular Number.

Nominative	Acid	um	Acidum, an acid
Genitive	Acid	i	Acidi, of an acid
Accusative	Acid	um	Acidum, an acid

Plural.

Nominative	Acid	a	Acida, acids
Genitive	Acid	orum	Acidorum, of acids
Accusative	Acid	a	Acida, acids

Notice that in the Neuter Gender the endings of the Nominative and Accusative are the same. This is also true of neuter nouns of all the declensions .

THIRD DECLENSION. All DECLINABLE pharmacopeial nouns having NOMINATIVE endings OTHER than "a" "us" "um" are of the third declension and are mostly masculine and feminine, with the five exceptions below noted.

The STEMS of this declension vary so much, in some cases being the entire nominative as "Liquor" (Nominative Liquor, Gen. Liquoris), in others being less as "Lotio" (Nom. Lotio, Gen. Lotionis), and in others changing a letter or altering the stem in some other way as "Pix" (Nom. Pix, Gen. Picis) that no definite example can be given.

A list of the principle words of this declension and their Genitives will be found at the end of this section. It is much easier to learn the Genitives of the nouns of this declension by heart, than to try to form them from a given example. After the Genitive is learned the stem can always be easily found by cutting off the ending. Any other case needed can be found by adding the proper case ending given below to the stem.

Masculine and Feminine Nouns.

	Singular	Plural
Nominative	various	es
Genitive	is	um
Accusative	em	es

Example, "Liquor." Genitive Liquoris. Stem Liquor.

Singular	Nom., Liquor	Gen. Liquor	Acc. Liquorem
Plural	Liquores	Liquorum	Liquores

NEUTER NOUNS. (Nominative and Accusative are the same.)

	Singular	Plural
Nominative	-	a
Genitive	is	um
Accusative	-	a

Example ‘‘Lac.’’				
Nom., Lac,	Gen., Lactis,	Stem, Lact.,		
Singular	Nom., Lac	Gen., Lactis	Acc., Lac	
Plural	Lacta	Lactum	Lacta	

It is much easier and simpler to learn the list of words and their genitives given in another place which for practical purposes answers very well as the use of any case other than the nominative or genitive is quite the exception.

The five exceptions to the rule that nouns ending otherwise than ‘‘a’’ or ‘‘us’’ belong to this declension are, ALOE and MASTICHES of the first and having the following endings:

	Singular	Plural
Nom.	Aloe	ae
Gen.	es	arum
Acc.	en	as
and Haematoxylon, Eriodictyon and Toxicodendron having these endings.		
	Singular	Plural
Nom.	Haematoxylon	a
Gen.	i	orum
Acc.	on	a

FOURTH DECLENSION. Three pharmacopeial nouns are of the Fourth Declension and are declined like Fructus. Fructus and Spiritus are masculine and Quercus feminine.

Singular Number			
Nominative	Spirit	us	Spiritus, Spirit
Genitive	Spirit	us	Spiritus, of Spirit
Accusative	Spirit	um	Spiritum, Spirit
Plural			
Nominative	Spirit	us	Spiritus, Spirit
Genitive	Spirit	uum	Spirituum, of Spirits
Accusative	Spirit	us	Spiritus, Spirits

The following table will show in condensed form the endings of the four declensions.

Singular Number						
	First	Second		Third	Fourth	
		Masc.	Neu.	Masc. and Fem.	Neu.	
Nominative	a	us	um	Various		us
Genitive	ae		i	is		us
Accusative	am		um	em	like Nom.	un

				Plural.			
Nominative	ae	i	a	es	a	us	
Genitive	arum	orum			um	uum	
Accusative	as	os	a	es	a	us	

A few nouns are undeclinable, that is have the same form in all cases in both singular and plural numbers.

A list of these is found appended. The adjectives used in prescription writing are declined like nouns having the same ending. That is adjectives ending in "a" are declined like *Tinctura*, those in "us" like *Rubus*, those in "um" like *Acidum*, and those having other endings are of the third declension and have their cases formed in the same manner as corresponding nouns.

Adjectives agree with the nouns they modify in gender, case and number, as *Pilulae Catharticae*, *Acidum Boricum*, etc.

An adjective may be of a different declension than the noun it modifies. In this case it will take the proper ending of the declension to which it belongs so as to agree with its noun according to the rule.

Example. "*Calx Chlorata*". Noun of third and adjective of first declension. "*Ferrum Sulphurata*." Noun of second and adjective of third.

The declension to which Pharmacopeial nouns belong may be summed up as follows:

Nouns ending in "a" belong to the First Declension and are declined like *Tinctura*.

Nouns ending in "us" or "um," with the exception of *Fructus*, *Quercus* and *Spiritus*, belong to the Second Declension and are declined like *Rubus* or *Acidum*.

Nouns having any other ending are of the Third Declension and form their cases according to the scheme already given. Their genitive singular always ends in "is"

Exceptions to this rule are the noun *Aloes* and *Mastiche* of the First, and *Hematoxylon*, *Eriodictyon* and *Toxicodendron* of the Second Declension.

Quercus, *Fructus* and *Spiritus* belong to the Fourth Declension and are declined like *Spiritus*. Their genitive singular is the same as the nominative singular.

LIST OF WORDS AND PHRASES.

Ad, to, up to
Ana, aa, of each

Mica panis, a bread crumb
Mistura, a mixture

Builliat, let it boil	Misce, mix
Cola, strain	Octarius "O," a pint
Cum, with	Partes equales, equal parts
Charta, a paper (medicated)	Pro re nata, as required
Chartulas, a little paper for a powder	Quantum sufficial "q. s.," a sufficient quantity
Detur, put	Ne repetatur, do not repeat
Dosis, a dose	Recipe, take
Dentur, take	Scatula, a box
Et, and	Semissis, a half
Fiat, let it be made	Signa, sign or mark
Fiant, let them be made	Sine, without
Gutta, a drop	Tales, such
Indies, daily	Tales doses, such doses
In, into	Ter in die, t. i. d., three times a day
Libra, a pound	

WORDS OF THE THIRD DECLENSION.

The first column contains the nominative and the second the genitive. The root of all these nouns and adjectives to which the proper case ending is added is the genitive form minus the ending 'is.'

Adeps	Adipis	Alcohol	Alcoholis
Alumen	Aluminis	Animalis	Animalis
Aspidosperma	Aspidospermatis	Boras	Boratis
Bos	Bovis	Calx	Calcis
Canadensis	Canadensis	Cantharis	Cantharidis
Carbo	Carbonis	Chloral	Chloralis
Colocynthis	Colocynthis	Confectio	Confectionis
Digitalis	Digitalis	Dulce	Dulcis
Effervescens	Effervescentis	Emulsio	Emulsionis
Fel	Fellis	Fortior	Fortiorio
Hamamelis	Hamamelidis	Hydras	Hydratis
Lac	Lactis	Limon	Limonis
Liquor	Liquoris	Lotio	Lotionis
Mite	Mitis	Molle	Mollis
Mucilago	Mucilaginis	Nux	Nucis
Pars	Partis	Pepo	Peponis
Physostigma	Physostimatis	Piper	Piperis
Pix	Picis	Pulvis	Pulveris
Radix	Radicis	Rhus	Rhois
Salicylas	Salicylatis	Sapo	Saponis

Semen	Seminis	Sinapis	Sinapis
Sulphur	Sulphuris	Theobroma	Theobromatis
Trituratio	Triturationis	Valerianas	Valerianatis
Viride	Viridis	Zingiber	Zingiberis

All the salts of the "ic" and "ous" acids which end in English in "ate" or "ite," as sulphate and sulphite, belong to this group also. To form the nominative singular, the letters "ate" or "ite" are simply changed into "as" and "is" respectively. The Genitive is formed by changing the letters "as" or "is" of the nominative into "atis" and "itis" respectively. The following examples will serve to illustrate this:

English.	Latin.	
	Nom.	Gen.
Acetate	Acetas	Acetatis
Arsenite	Arsenis	Arsenitis
Benzoate	Benzoas	Benzoatis
Carbonate	Carbonas	Carbonatis
Hydrate	Hydras	Hydratis
Phosphite	Phosphis	Phosphitis
Sulphate	Sulphas	Sulphatis
Salicylate	Salicylas	Salicylatis

The following nouns are generally considered indeclinable and the same form is used in all the different cases:

Amyl	Catechu	Elixir	Menthol	Phenol	Salol
Buchu	Cusso	Eucalyptol	Methyl	Pyrogallol	Sassafras
Cajupti	Diacylon	Kino	Naphthol	Quebracho	Thymol

PHARMACY

Pharmacy is that portion of Pharmacology which treats of the art of preparing and dispensing drugs. The different forms in which they are prepared and dispensed are as follows:

WATERS (Aqua) are solutions of volatile substances in water and are prepared by dissolving or distilling the substances with water.

LIQUORS (Liquoris) are solutions of non-volatile substances in water.

SYRUPS (Syrupus) are nearly saturated solutions of sugar and water. There are a number of official syrups in which in addition to the sugar and water there is some medicinal or aromatic substance dissolved, such as Syrupus Aurantii or Syrupus Tolutani. Most of them are used as vehicles or excipients to give form or taste to a prescription. *Simple syrup 30%.*

ELIXIRS (Elixaria) are a class of elegant preparations composed

Spiritus Alc. ext of soluble substances.
Vini ext & wine.
recta " i benigna.

of water, sugar, alcohol and aromatics. They have a pleasant taste and are used to mask the taste of bitter or nauseous drugs, making an excellent vehicle for an otherwise unpleasant mixture.

GLYCERITES (Glycerita) are solutions of substances in glycerine.

MUCILAGES (Mucilago) are solutions of colloid substances in water and are usually of considerable consistency. They are chiefly employed as vehicles in mixtures to aid in suspending insoluble substances, as emulsifying agents and as excipients for pills and troches. The U. S. P. contains four: Mucilago Acaciae, Sassafras Medullae, Tragacanthae and Ulmi.

TINCTURES (Tinctura) are solutions of non-volatile drugs prepared by extracting with menstrua of alcohol and water in various proportions. They are also prepared by maceration and filtration and by percolation.

Assayed Tinctures are those which are required to be made of a certain definite alkaloid strength. The two most important are:

Tincture of Opium which should be of such a strength as to contain 1.3-1.5% of Morphine.

Tincture of Nux Vomica which contain 0.3% of total alkaloids.

FLUID EXTRACTS (Extractum Fluidum) may be defined as concentrated tinctures of such strength as to represent the drug volume for weight, that is each cubic centimeter of the fluid extract is supposed to be equivalent to one gram of the crude drug.

Certain extracts are Standardized, that is are brought to a certain fixed alkaloidal strength either by evaporation or by the addition of menstrua to them so that each c.c. of their volume is equivalent to a given amount of the alkaloid. As with tinctures, the extracts of Nux Vomica and Opium are the principal ones standardized.

EXTRACTS (Extracta) or solid extracts as they are termed to distinguish them from fluid extracts are the soluble active principles of drugs concentrated by evaporation so as to be of semi-solid or plastic consistency. The strength of the extract depends upon the amount of the crude drug it represents, hence the smaller the percentage of an extract obtained from a drug the greater the strength of the extract, provided that the drug is extracted with suitable menstrum. To obtain the extracts therefore of official strength official menstrua must be used. No definite relative value can be given to solid extracts as the amount yielded varies greatly with the drug.

Tinctures, fluid extracts and extracts comprise the bulk of the preparations of the U. S. P. The principal forms in which drugs are prescribed are as follows:

Triturations - \bar{c} lactose.

~~Confectios - \bar{c} honey, sugar, flavors,~~
~~a sem solid.~~

Mellita - same \bar{c} honey.

POWDERS (Pulveris). A powder (pulvis) is a definite given ~~amount of a finely pulverized~~ and mixed drug or drugs. Powders are prescribed in two forms, the amount intended for a single dose or the amount for a number of doses, which is then ordered to be divided into that number of single powders. This is fully explained in the section on Prescription Writing.

Powders may be divided into two classes:

1. Those in which the active basis constitutes the greater portion or the whole of the powder.

2. Those in which the dose of the drug is so small that it would be impossible to administer it unless some excipient was added to make it of sufficient bulk so that it can be handled or taken conveniently. In this latter case some inert substance, such as sugar of milk, starch, etc., is used as an excipient. Powders should not be ordered of a larger size than 1.000 or 1.500. From 0.300 to 1.000 is a very fair size.

If a powder is deliquescent and is prescribed in single doses it should be ordered to be put up in wax paper (Detur in chartulas cerati), but drugs of this description are preferably given in solution.

If it is desired that the drug be taken in more accurate doses than is possible by the ordinary methods, or if the taste is unpleasant or bitter it may be ordered to be enclosed in gelatin capsules or conseals, both of which are made in various sizes.

Gelatin Capsules (Capsular Gelatinosa) are about the shape of rifle bullets and are made in two parts, one of which slips inside of the other. The powder is put into the smaller portion which is then slipped inside the other half, forming a smooth, conical mass, looking very much like a rifle bullet except that both ends are rounded. To order them either of the following phrases may be used:

R Olei Ricini 4.00

Detur in capsulas gelatinosas

or

R Capsulatum Gelatinosarum Olei Ricini 4.00

Conseals or Konseals are discs of a wafer like substance with a depressed centre varying in size from a dime to a quarter. The drug is placed in one disc and another is applied to it by various devices. When they are moistened with water they become very slippery and may be readily swallowed. If you desire a powder put in capsules or conseals the phrase "in capsules" or "in conseals" is used instead of "in chartulas."

Where the basis of the pill constitutes only a small part of the mass some excipient such as bolus alba, sapo medicatus, mica panis or a dry extract is used as excipient. If the largest part of the pill is formed by the active principle in the form of a dry extract, resin or gum, dilute alcohol or mucilage is used as the excipient. If the drug is in semi-liquid or liquid form some dry extract or powder which possesses but little active properties is used as the excipient. For example:

R	Extracti Belladonnae Radicis Fluidi	1.80
	Pulveris Glycyrrhizae	4.00
	Fiant pilulae No. XXX.	

The following substances are not suitable to be prescribed in pill form:

Acids, alkalies and mineral salts with the exception of salts of the heavy metals as silver nitrate, which may be dispensed in small quantities in pill form. Silver nitrate and some other salts decompose readily when mixed with organic substances, therefore in such cases we have to use some inorganic substance as excipient as Bolus Alba. Example:

R	Argenti Nitratis	0.020
	Bolis Albae	0.200
	Aquae Destillatae q. s.	
	Fiat Pilula	

Carbolic acid may be prescribed in pill form and is the exception to the rule just given. For example

R	Acidi Aarbolici Liquefacti	0.030
	Morphinae Sulphatis	0.004
	Pulveris Cinnamoni	
	Extracti Gentianae	aa q. s.
	Ut fiat pilula	

In most cases in prescribing for pills it is better to leave the choice of the excipient to the pharmacist as he is generally better able to determine which one is best to use.

If the pills ordered are likely to be sticky they are generally directed to be sprinkled with powder. In such cases the term "Consperge Pulveri" is added to the directions to the pharmacist. For some reasons, such as bad taste, etc., you may desire to coat the pill. The terms then used are:

Obducende folius argenti (silver foil)

“ gelatina

“ salol

If you desire the pills to pass through the stomach unchanged and to act upon the small intestine it should be ordered coated with Salol, which is not acted upon in the stomach but is decomposed in the intestine. This is the best coating for pills of this kind.

Pills are mainly used when a long and continuous action is desired or when it is desired to have the drug act mainly on the intestine. Most of them contain colloids so that they reach the intestine easily.

There are a large number of official pills in the U. S. P. In writing prescriptions for these the name of the pill must be put in the accusative case and not in the genitive as is the usual rule, as

R Pillulas Cartharticas Compositas No. X.

See the section on Prescription writing for further explanation of this.

TROCHES (Trochiscis) or lozenges are dried tablets of sugar, gum, mucilage, water and one or more active ingredients previously uniformly mixed or dissolved. They are usually intended to be held in the mouth or let slowly dissolve as their action is intended to be mainly on the pharynx and throat therefore they should be pleasant to the taste. *Flat. Used mostly in Inf.*

ELECTUARIA or CONFECTIONS are semi-solid masses composed of powdered drugs or salts thoroughly mixed with honey or sugar and mucilage. U. S. P. has two

Confectio Rosae (use only as a pill mass.)

“ Sennae (a very agreeable laxative for women and children.)

OINTMENTS (Unguentum) are composed of the active drug and some basis such as lard, lanolin, vaseline, etc., which is solid at ordinary temperature but which melts at that of the body. They are for use on the surface of the body and are intended to be applied by rubbing or inunction. The action of some is intended to be local while of others it is intended to be general, the active drug penetrating the skin as a result of its incorporation with an oily base and the subsequent rubbing.

They should not contain any hard or undissolved particles therefore if the drug is insoluble in the base it may be necessary to dissolve it in some solvent, before its incorporation with it.

Olea. — Oils fixed & volatile. Olive, cotton
fixed. Bergamot volatile.

Collodia — gum cotton in alc. or ether cat
medication.

Glycerite — Sol of drugs in glycerine.

ones in use are, *Emplastrum Plumbi*, *Resinae* (adhesive plaster) and *Ichthyocollae* (court plaster). The Lead plaster is generally used as the base where a special plaster is prescribed.

The following are the liquid forms in which drugs are dispensed,
1. Liquids or solutions. 2. Mixtures.

LIQUIDS contain one substance completely dissolved in a solvent. As solvents water, chloroform, glycerine, alcohol, ether, etc., are used.

MIXTURES are liquid preparations containing more than one active drug in solution or one or more drugs in suspension. In case the mixture contains an insoluble drug it should bear a "Shake" label. To prevent the quick precipitation of insoluble substances from a mixture one of the syrups or mucilaginous compounds is added. This assists materially by keeping them in suspension for a much longer time than they otherwise would be. The preparations usually employed for this purpose are, *Syrupus Acaciae*, and *Althaeae*, *Mucilago Acaciae*, *Tragacanthae* and *Ulmi* and *Decotio Cetrariae*. If a mixture has an unpleasant taste or is likely to prove disagreeable to the patient for any other reason, it is customary to add to it some excipient which will render it more palatable.

This is quite an important point as sometimes a medicine because of its unpleasant taste or odor will produce a mental or physical effect upon a patient which will modify its action materially. Of course this cannot always be done as oftentimes a modification of the taste of a medicine would mean a change in its action, as for instance, the bitters.

The substances generally used for this purpose are the syrups and aromatic waters. These are also very frequently used to bring a mixture up to the desired quantity and as their action is slight or of no effect in the ordinary dose of a teaspoonful, they are very useful for this purpose and at the same time make a more elegant preparation.

INFUSA are liquid preparations of organic drugs made by the use of water as a menstrum. Hot water is poured over the coarsely powdered drug and the whole allowed to stand for about a half-hour. It is then strained and brought to the standard strength by the addition of sufficient quantity of water. Infusions of drugs whose active principles are volatile or changed by heat are prepared by the use of cold instead of hot water. The U. S. P. contains:

Infusum Digitalis (Dose 4-16 c.c.)
 “ Cinchonae
 “ Sennae Compostum (Black Draught)
 “ Pruni Virginianae

DECOCTA are prepared in the same way as Infusion except that the drug is to be boiled first with water for 15-20 minutes. Unless especially ordered otherwise Infusions and Decoctions are made of a strength of one to twenty according to this formula:

Coarsely powdered drug	5.
Boiling water	100.

This is the proportion used in preparing those of the U. S. P. unless they have a given formula of their own. U. S. P. contains:

Decoctum Cetrariae
 “ Sarsaparillae Compositum.

In ordering decoctions or infusions to be made their strength should always be given especially if they are to be made of powerful drugs. Example:

R	Corticis Cinchonae	15.
	Fiat decoctum. Colatura	ad 200.

Infusion and decoctions should always be freshly prepared as they do not keep well.

EMULSA are liquid preparations consisting of oily or resinous substance suspended in water by the aid of some emulsifying agent. The exact action of this agent is not definitely known. Emulsions are prescribed when it is wished to apply a substance insoluble in water upon a mucous membrane of the intestinal tract in finely divided form. Only a certain number of drugs can be used in the form of emulsions. Acids and alkalies, large quantities of alcoholic solutions, and salts which precipitate gums and resins are the principal classes excluded. As a rule only small quantities of the active drug should be added to the emulsion.

The emulsifying agents used are gums, mucilage or other viscid substances. The most common one in use is Powdered Acacia.

Emulsions are divided into two classes, natural and artificial. Natural emulsions are those in which the emulsifying agent is intimately combined with the substance to be emulsified. As for instance the Emulsion of Ammoniacum is made by rubbing up four grams of resin of Ammoniacum with 100 c.c. of water.

Artificial ones are those in which some emulsifying agent has to be added to the mixture, as acacia, in the following of cod liver oil:

R	Olei Morrhuæ	30	000
	Pulveris Acaciæ	7	500
	Olei Gaultheriæ		
	Olei Amygdalæ	aa	150
	Aquæ	30	000
	Fiat Emulsum		

MIXTURES are given various names depending upon their mode of administration, viz.:

LOTIONES or washes are for external use and intended to be applied by washing or on lint.

INJECTIONES, are for introduction into the body by means of a syringe, usually through some of the orifices. They may however be introduced into the subcutaneous tissues by means of a proper syringe, then they are called Hypodermic Injections.

ENEMATA are intended to be administered by the rectum. Their object is either to evacuate the bowels or to act as food. In the latter case they are termed Nutrient Enemata.

GARGARISMA is a solution intended to be applied to the fauces by gargling:

COLLYIA are eye washes.

VAPORIS are preparations administered in the form of vapor or gas. They are volatilized either by their addition to boiling water or by the use of specially prepared apparatus.

I N D E X .

Acacia	77	Benzoic Acid	48	Cocaine	31
Acetanilid	47	Bismuth	112	Codeina	14
Acetic Acid	86	Bitters	72	Colchicum	56
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